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(12) **United States Patent**  
**Garceau**

(10) **Patent No.:** **US 11,639,129 B2**  
(45) **Date of Patent:** **May 2, 2023**

- (54) **SLIDABLE ROOM ASSEMBLIES**
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(US)
- (73) Assignee: **NORCO INDUSTRIES, INC.**,  
Compton, CA (US)
- (\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 416 days.

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- (21) Appl. No.: **16/570,136**
- (22) Filed: **Sep. 13, 2019**
- (65) **Prior Publication Data**  
US 2020/0062164 A1 Feb. 27, 2020

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- Related U.S. Application Data**
- (63) Continuation-in-part of application No. 16/136,528,  
filed on Sep. 20, 2018, now abandoned.
  - (60) Provisional application No. 62/858,712, filed on Jun.  
7, 2019, provisional application No. 62/732,330, filed  
on Sep. 17, 2018, provisional application No.  
62/562,084, filed on Sep. 22, 2017.

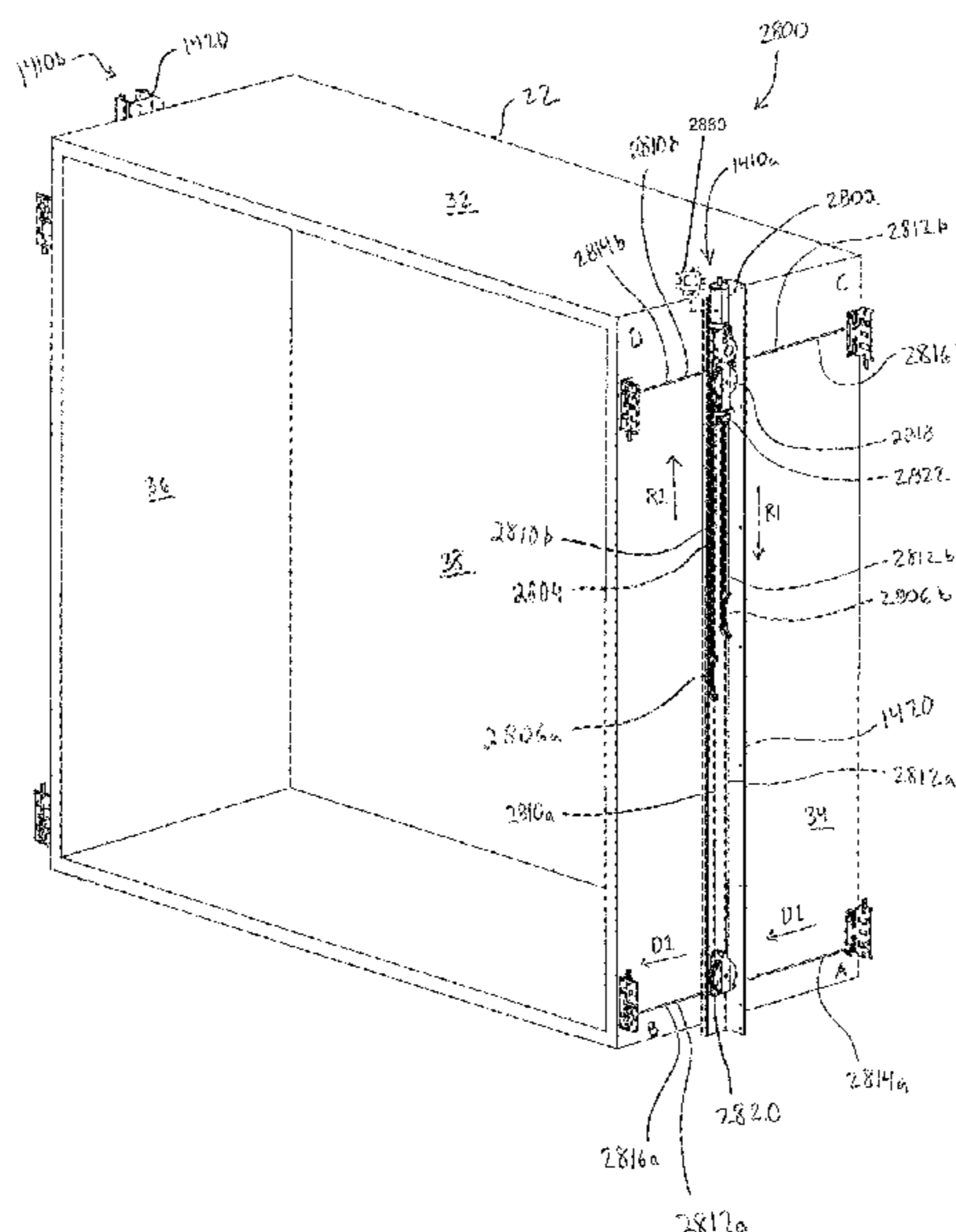
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(74) *Attorney, Agent, or Firm* — Vorys, Sater, Seymour  
and Pease LLP; Jacob M. Busch, Esq.

- (51) **Int. Cl.**  
**B60P 3/34** (2006.01)  
**F16H 7/06** (2006.01)
- (52) **U.S. Cl.**  
CPC . **B60P 3/34** (2013.01); **F16H 7/06** (2013.01)
- (58) **Field of Classification Search**  
CPC ..... F16H 19/0618; B60P 3/34  
USPC ... 296/26.13, 26.01, 26.08, 26.09, 165, 171,  
296/172, 173, 175, 176  
See application file for complete search history.

(57) **ABSTRACT**

A slide-out unit drive assembly for a vehicle body having an opening formed in an exterior wall and a reciprocable slide-out unit disposed in the opening and slidable between a retracted position and an extended position. Sliding movement of the slide-out unit is controlled by the drive assembly at least partially arranged within the jambs. The drive assembly may include one or more drive cables extending connected to the slide-out. The drive assembly may include drive chain that actuates one or more of the drive cables, or the drive assembly may include a drive nut that actuates one or more of the drive cables, or the drive assembly may include a block and tackle assembly that actuates one or more of the drive cables. Sliding movement of the slide-out unit may be either motor driven or manually powered.

**27 Claims, 59 Drawing Sheets**



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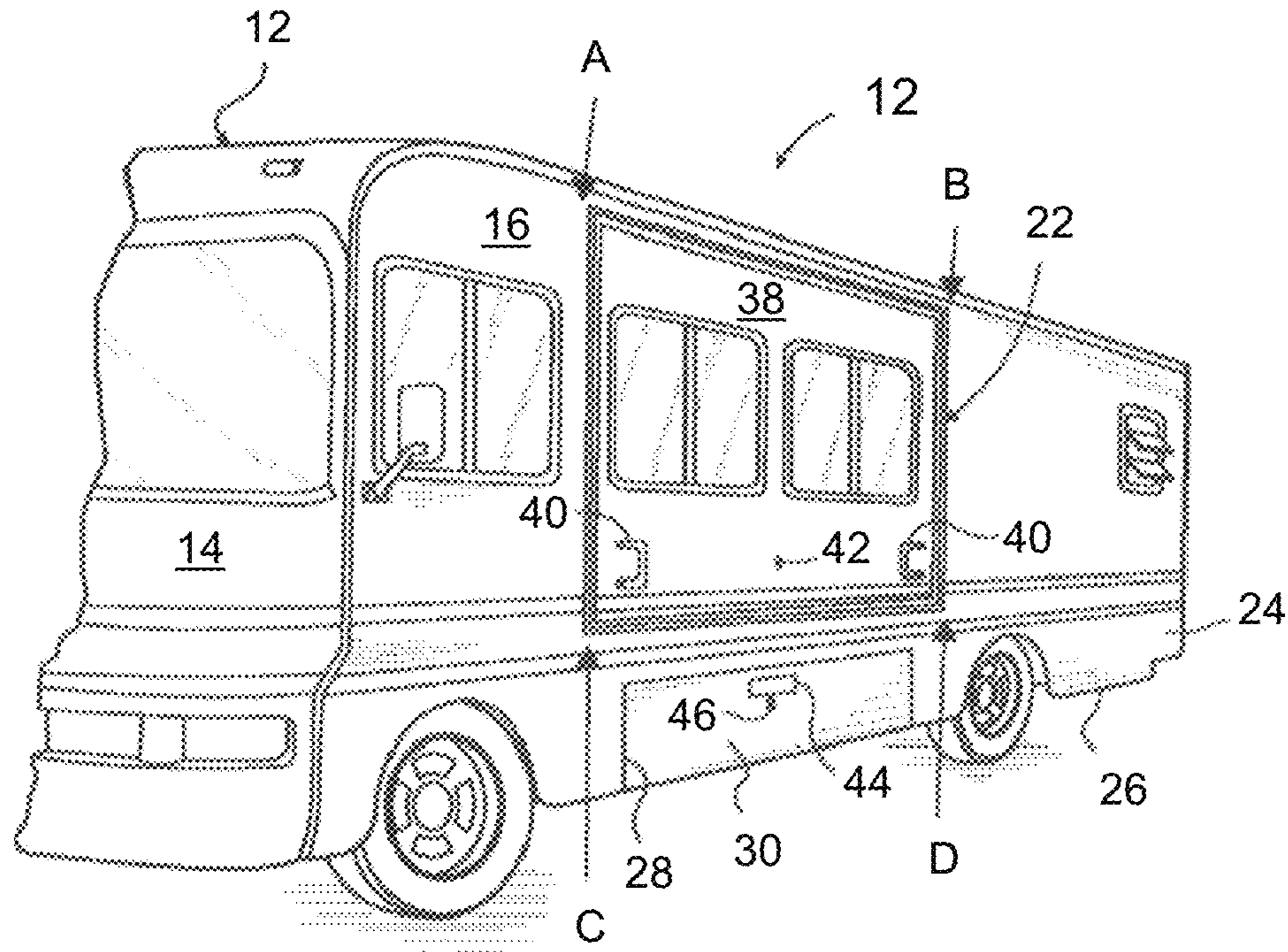
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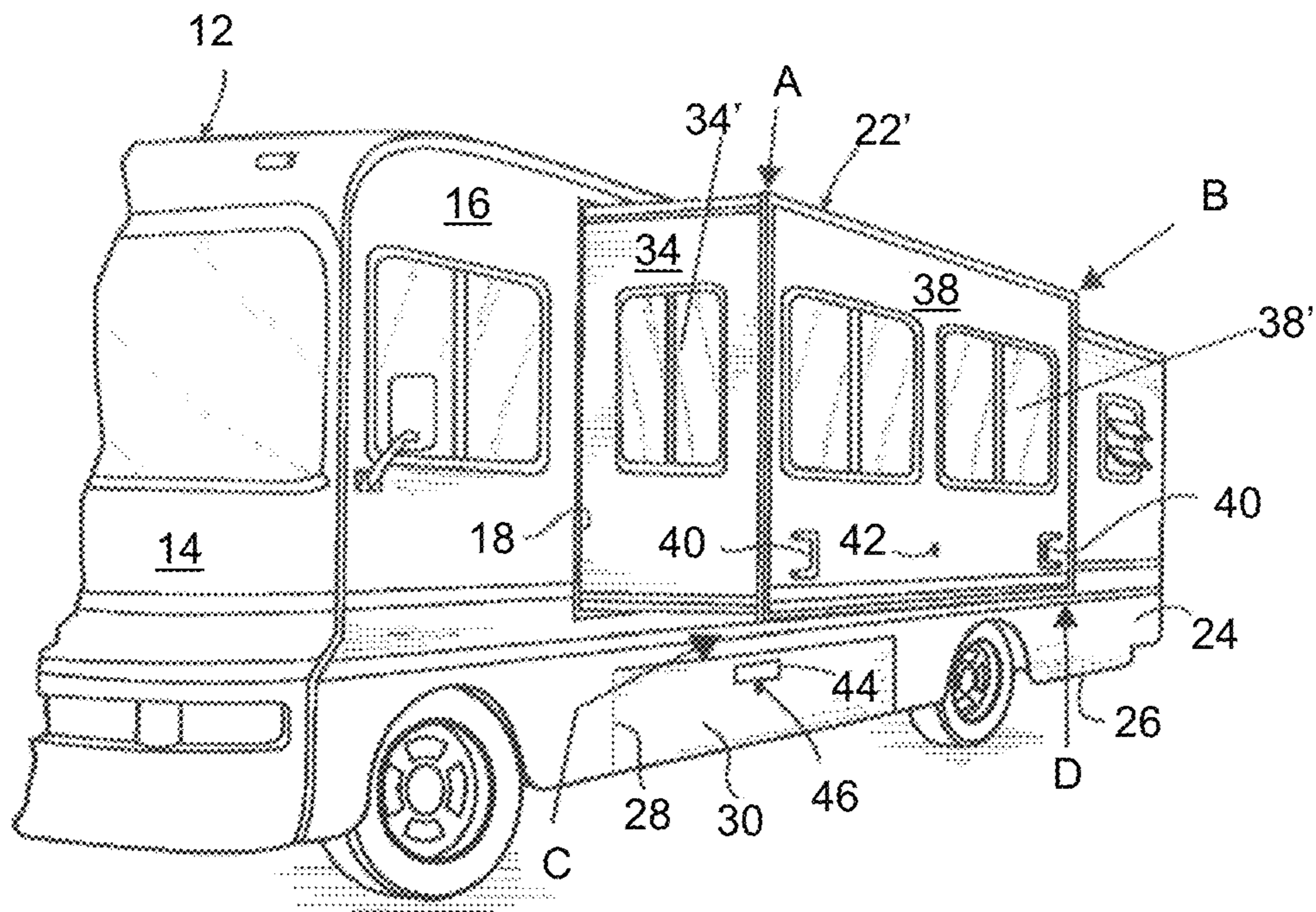
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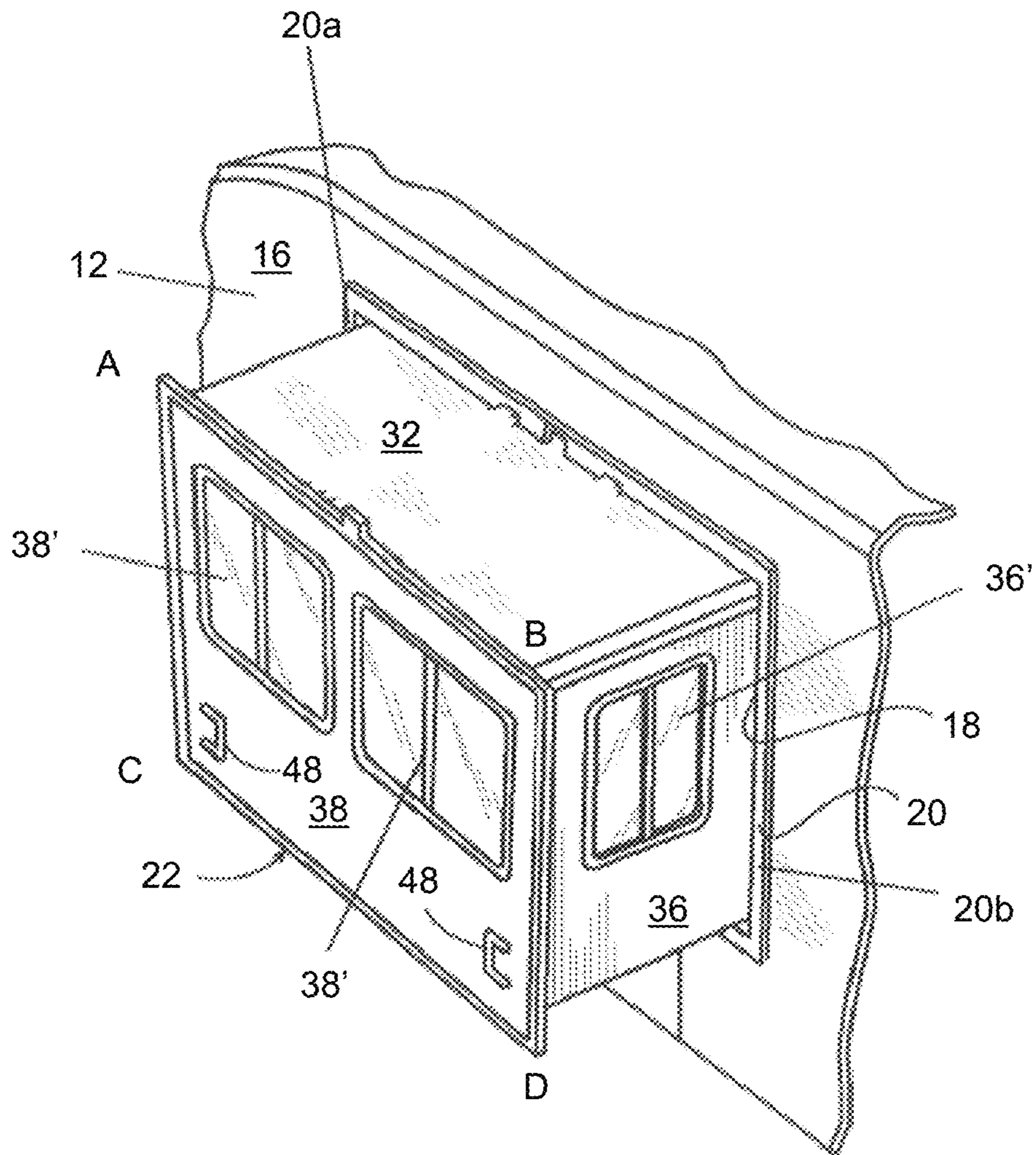




**FIG. 1**

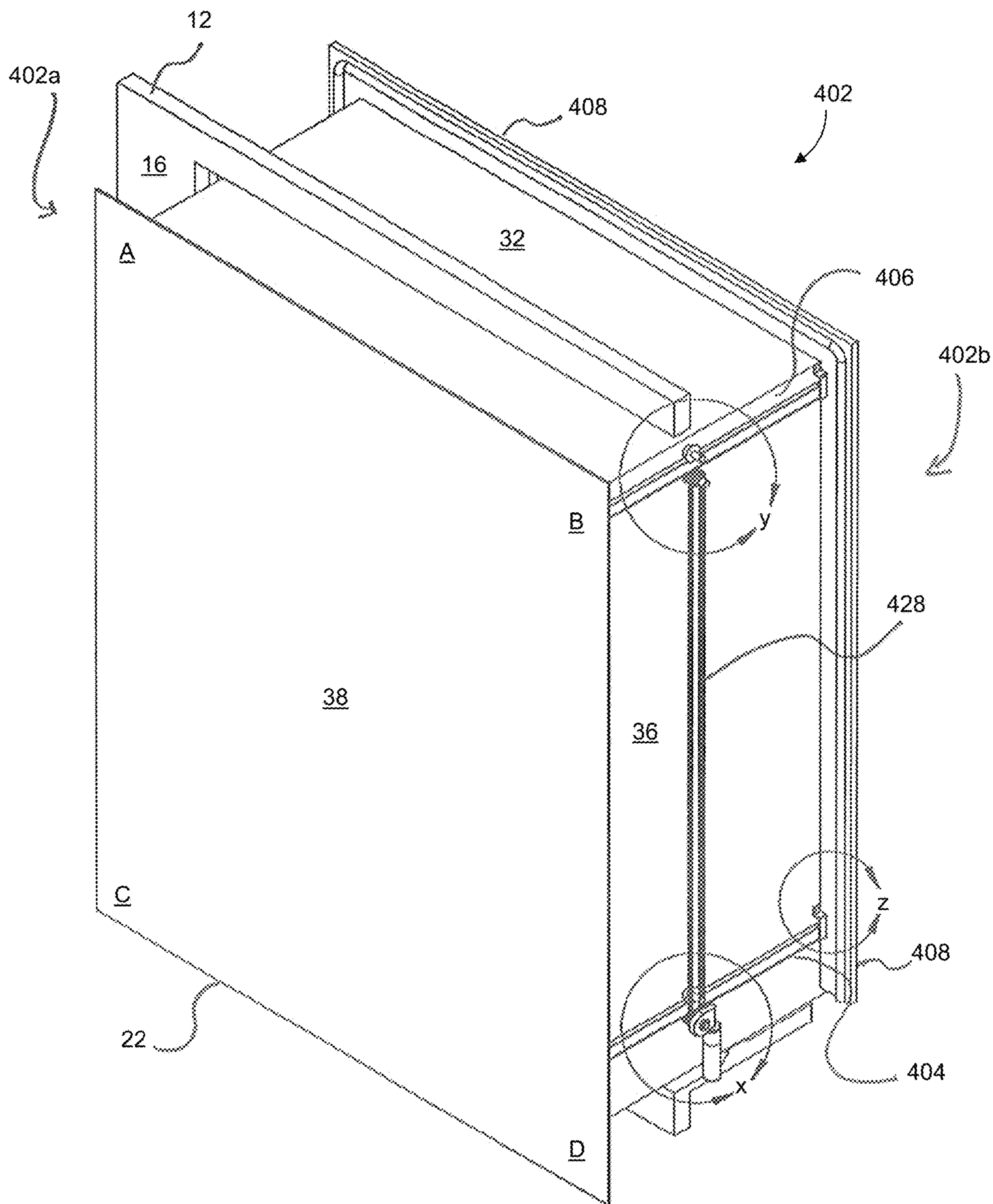


**FIG. 2**

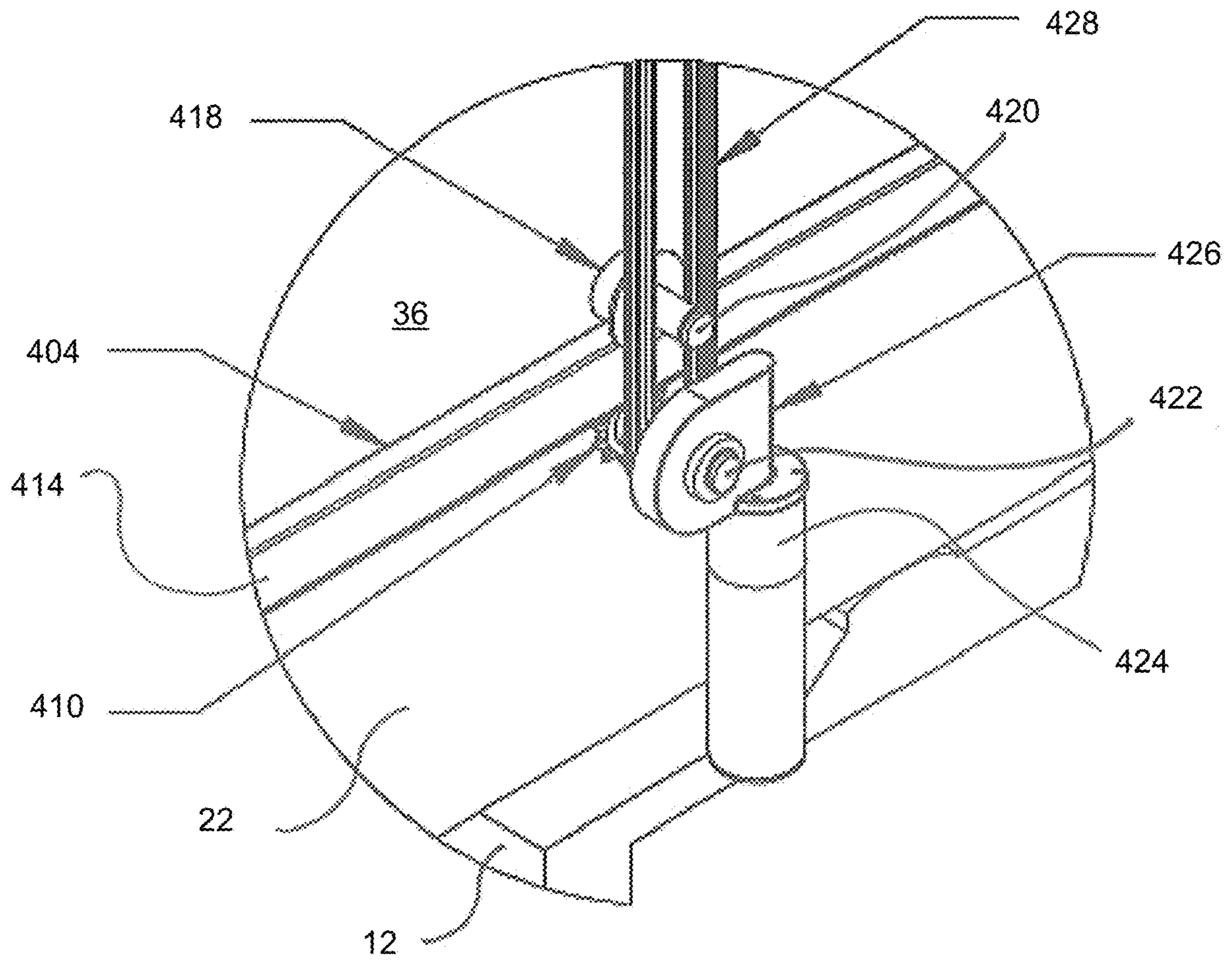


**FIG.3**

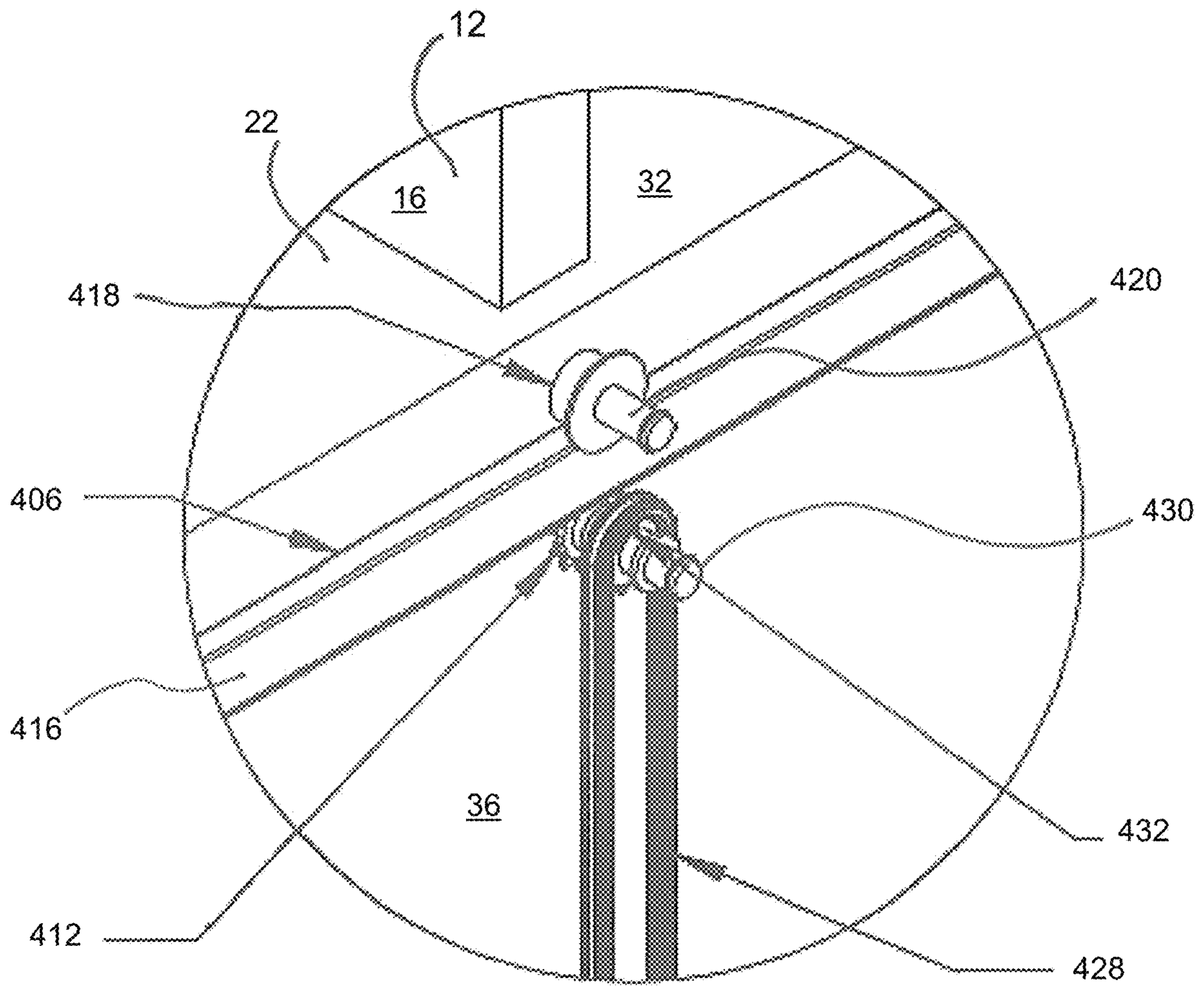




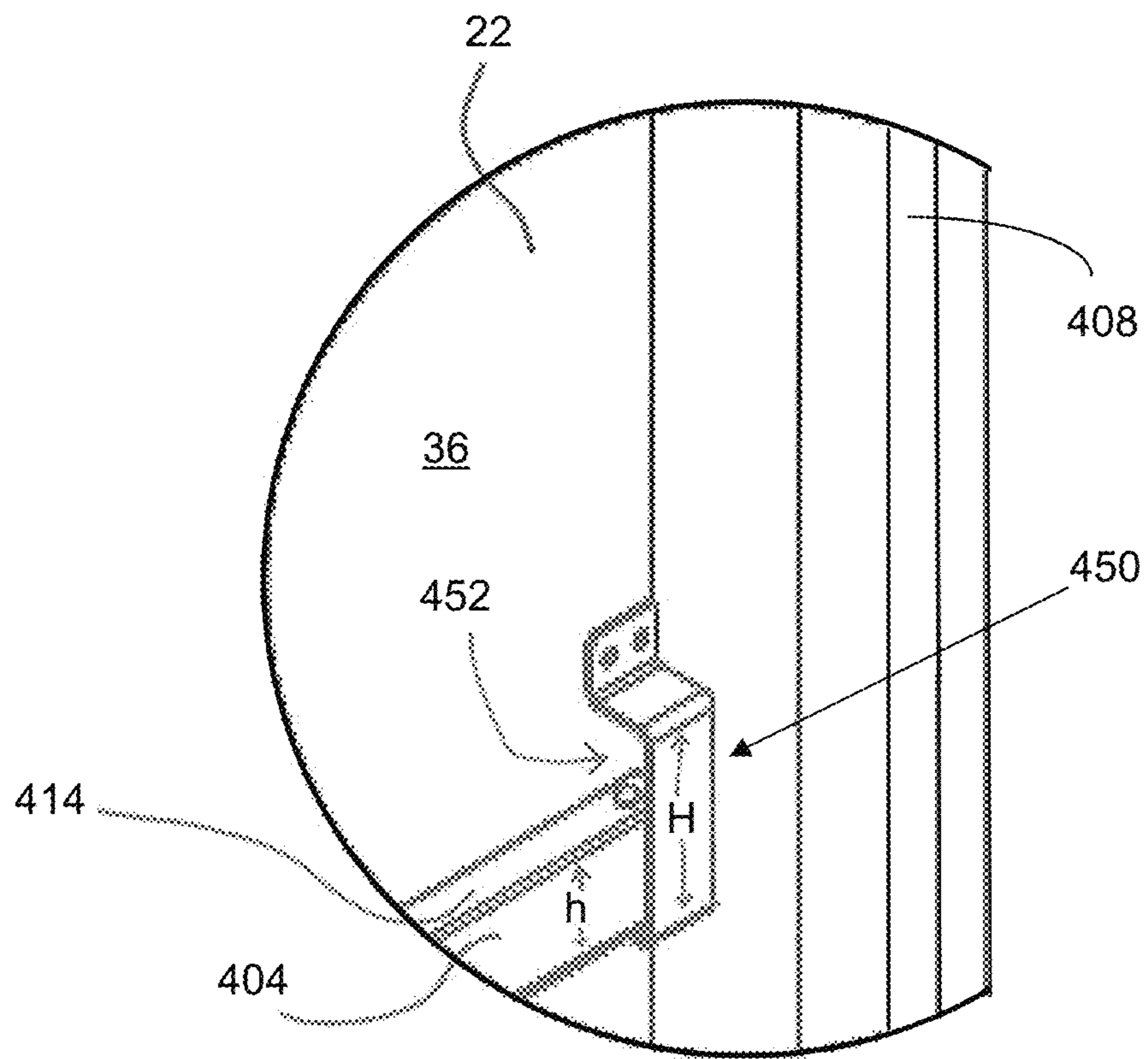
**FIG. 4**



**FIG.5A**

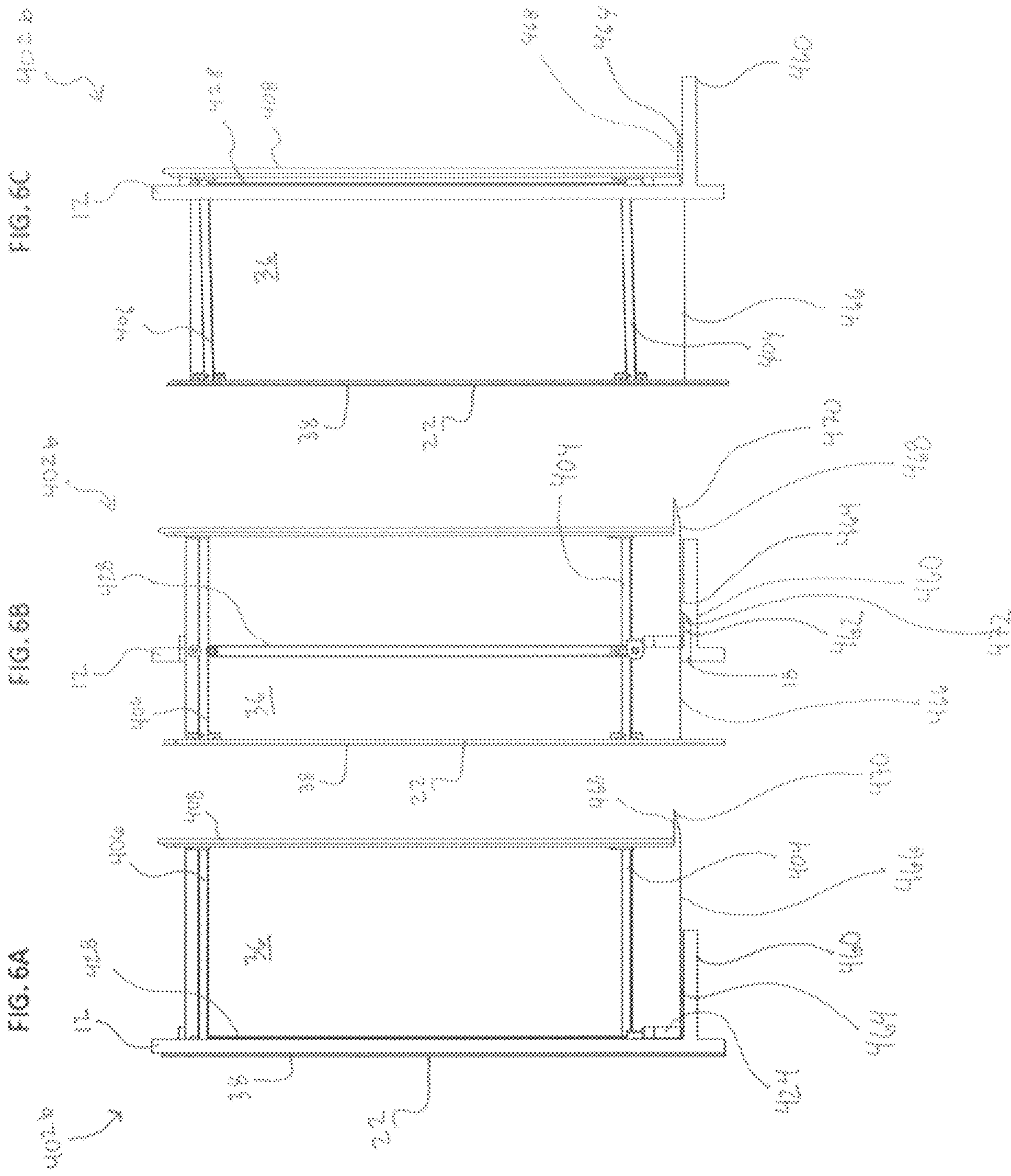


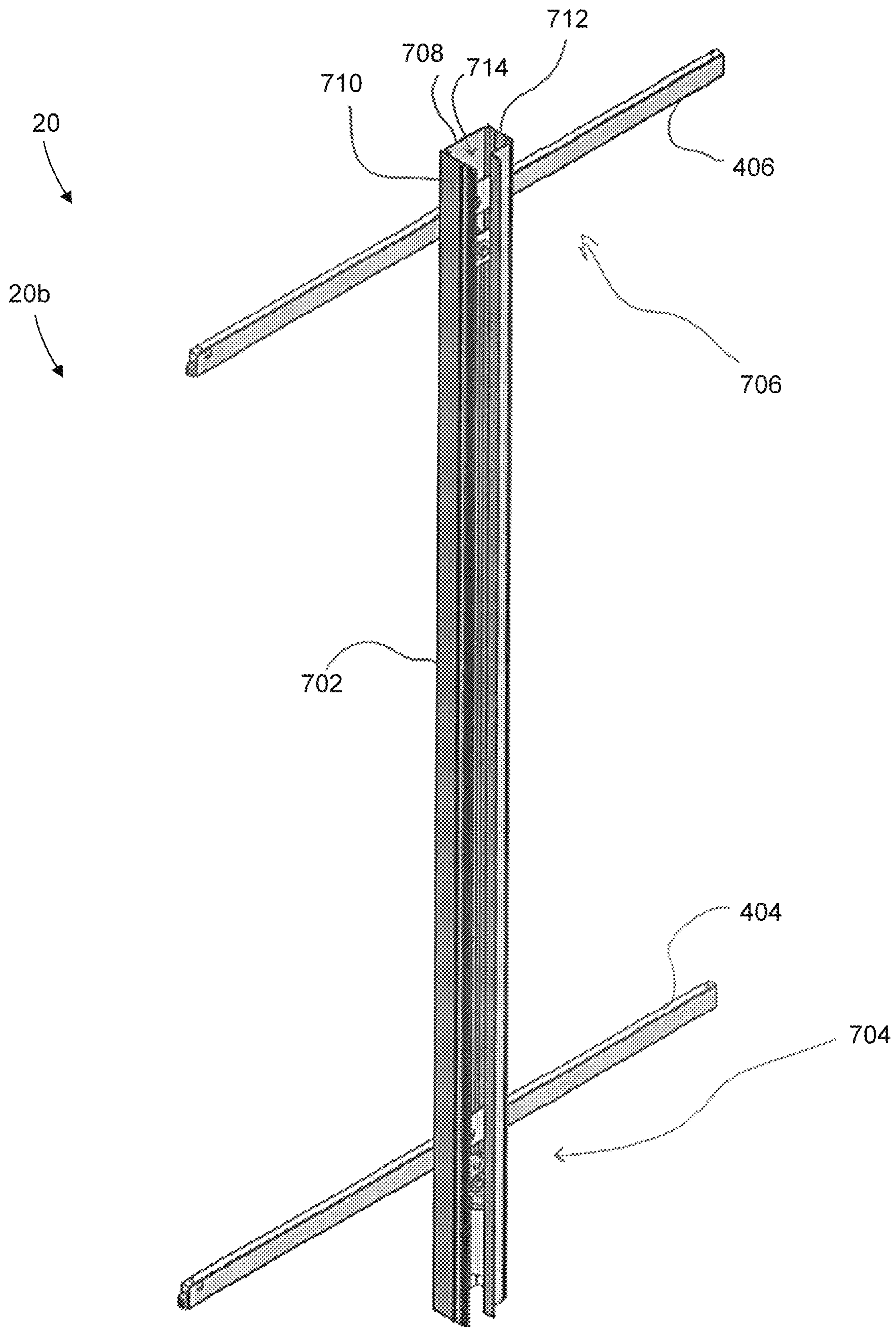
**FIG.5B**



**FIG.5C**

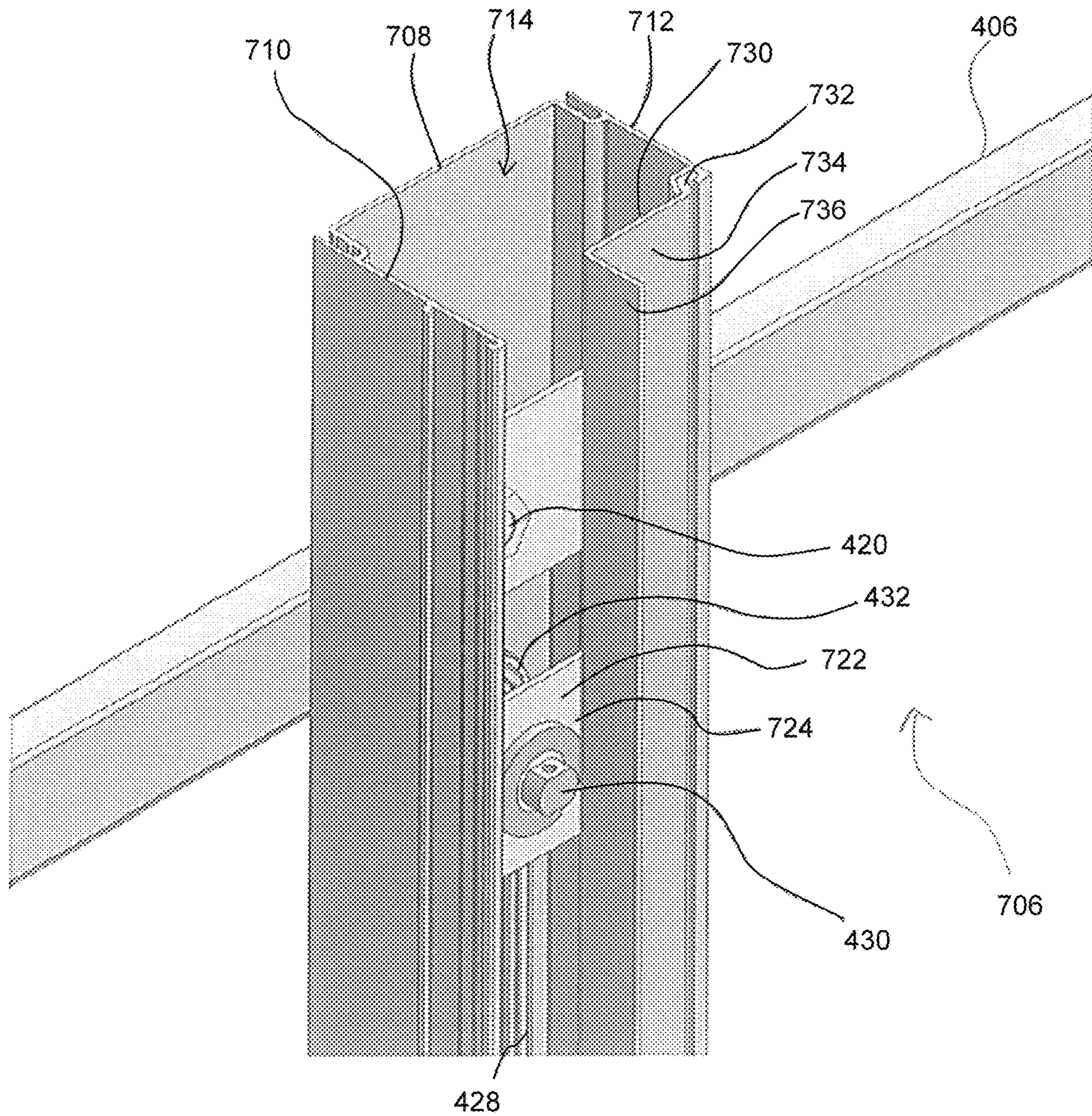






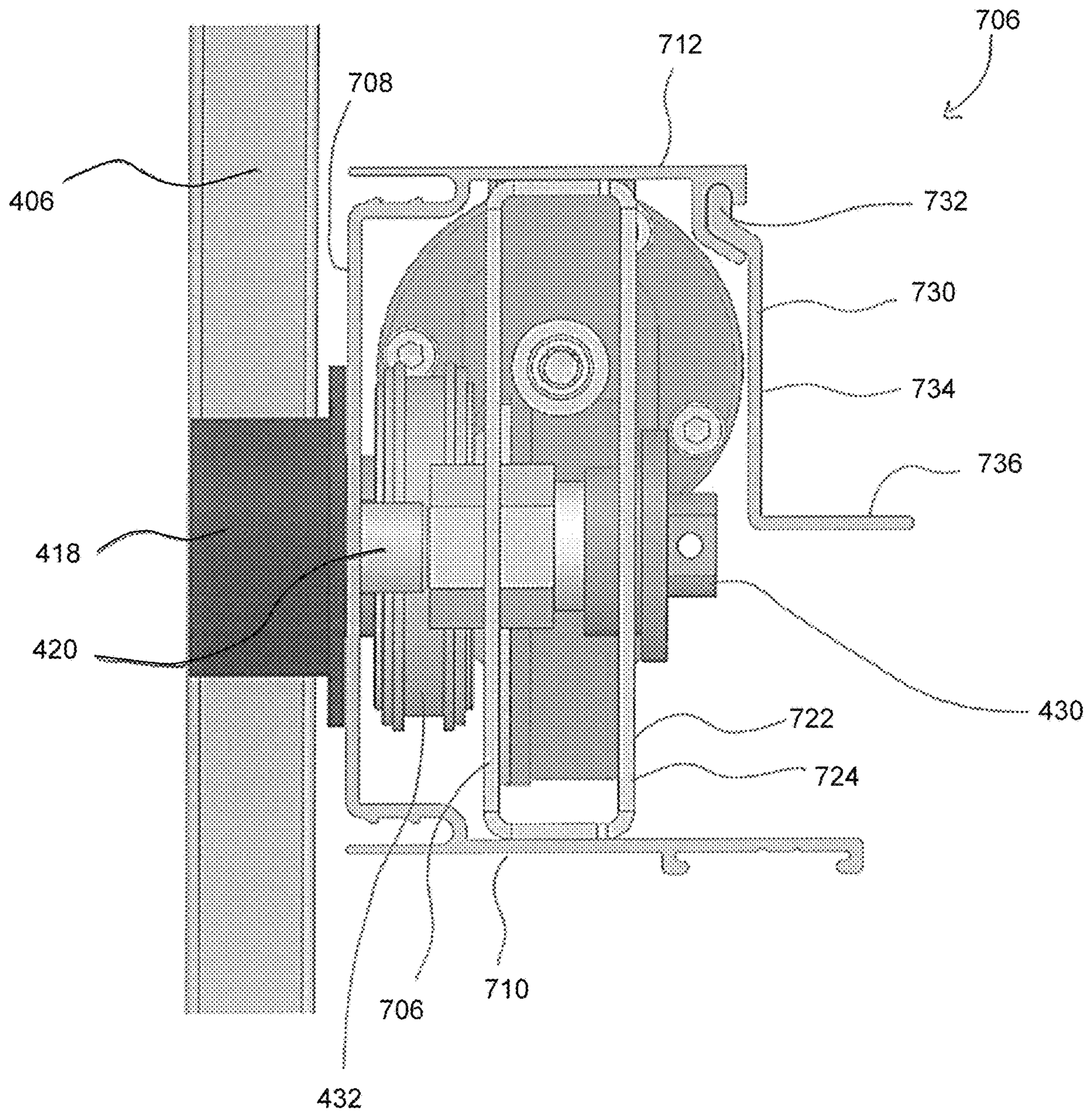
**FIG.7A**





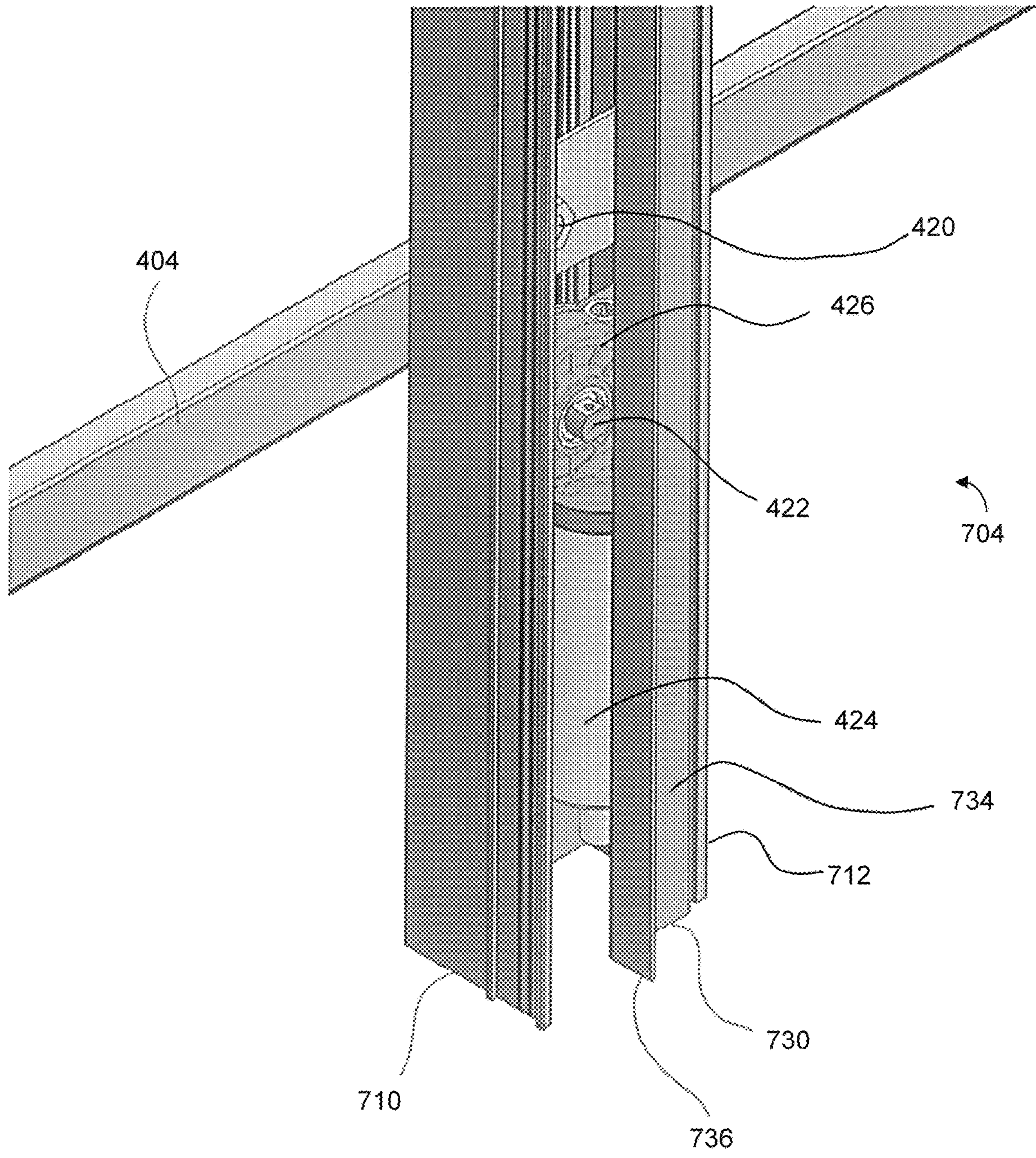
**FIG.7B**





**FIG.7C**





**FIG.7D**



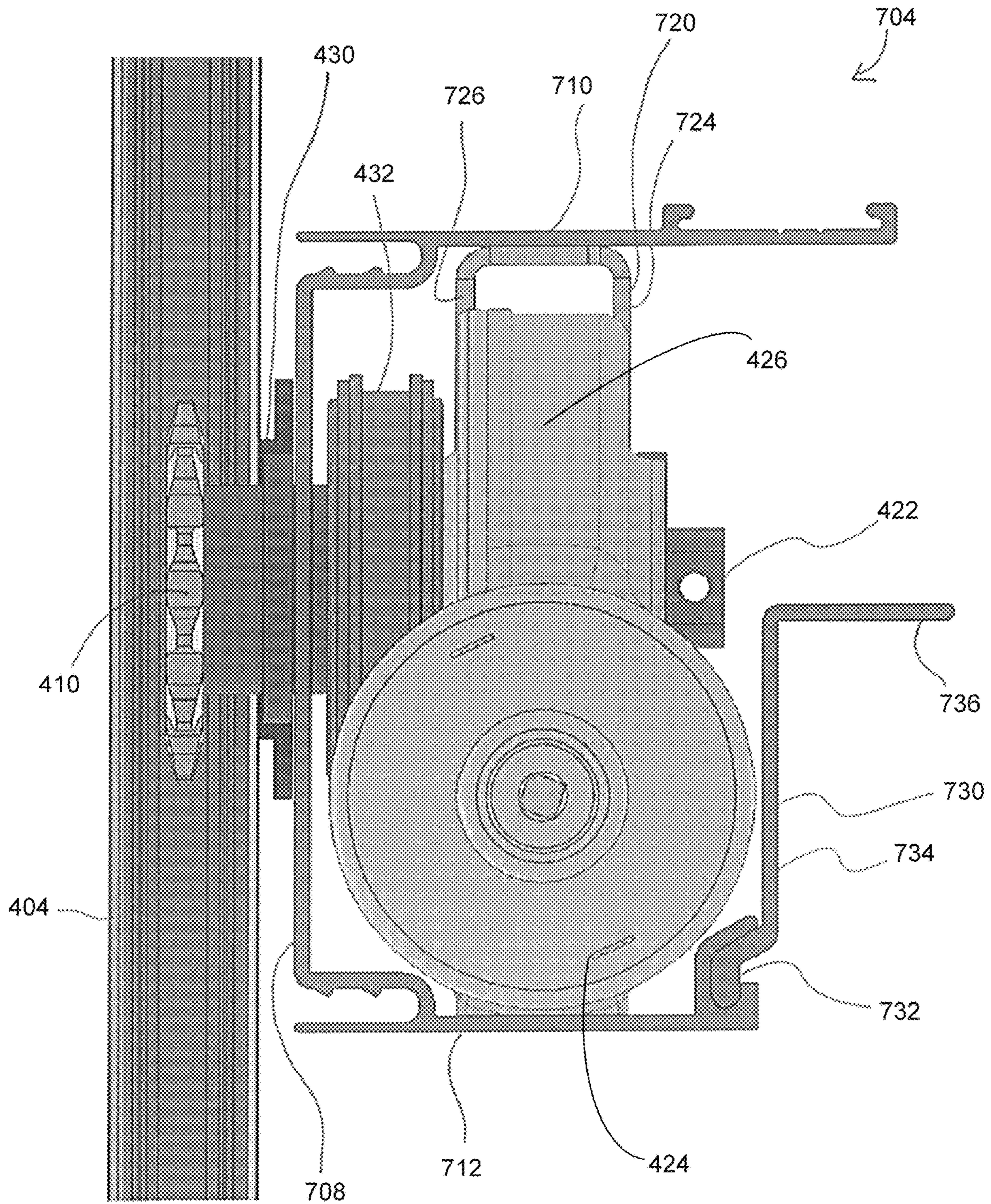
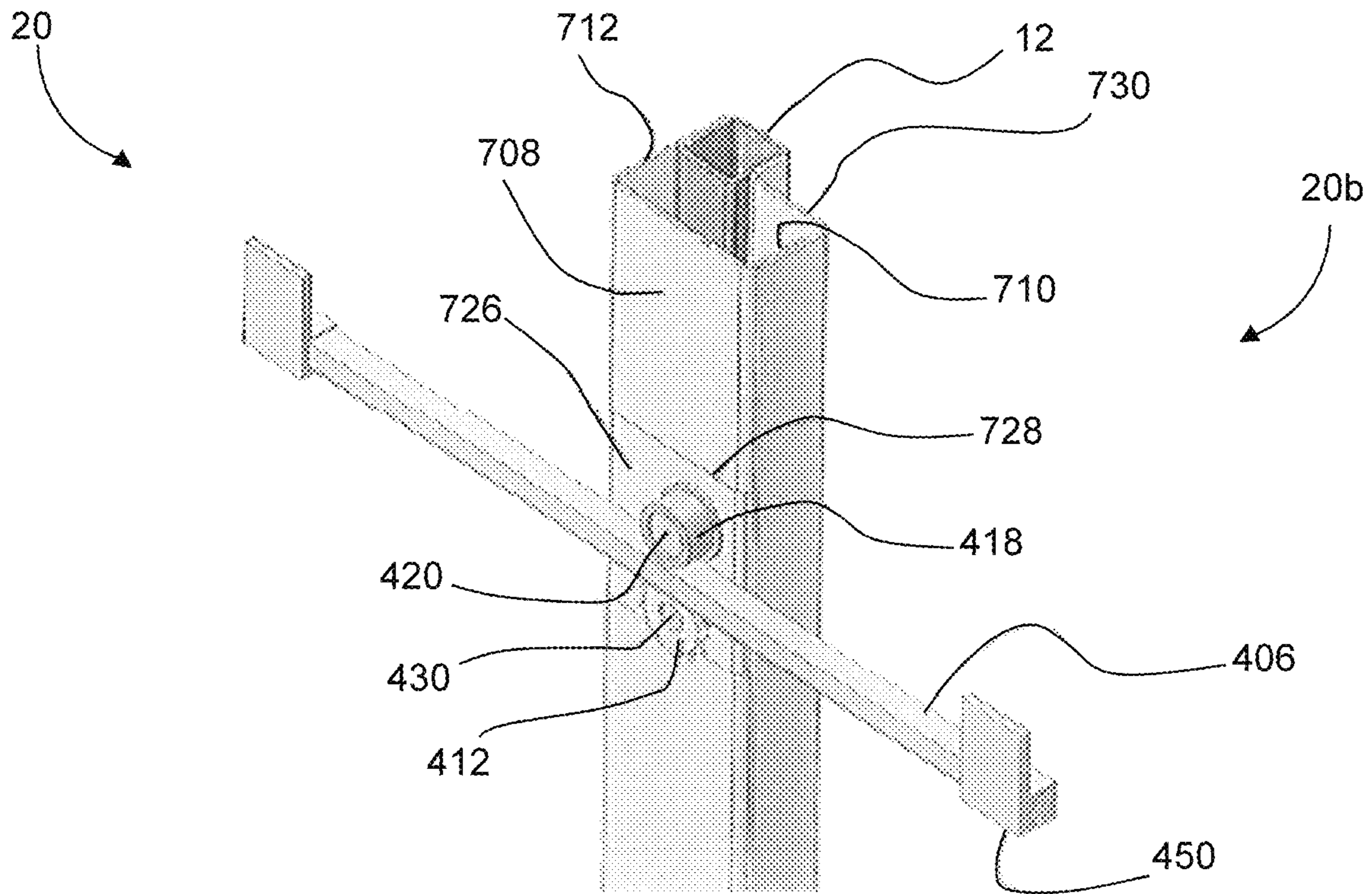


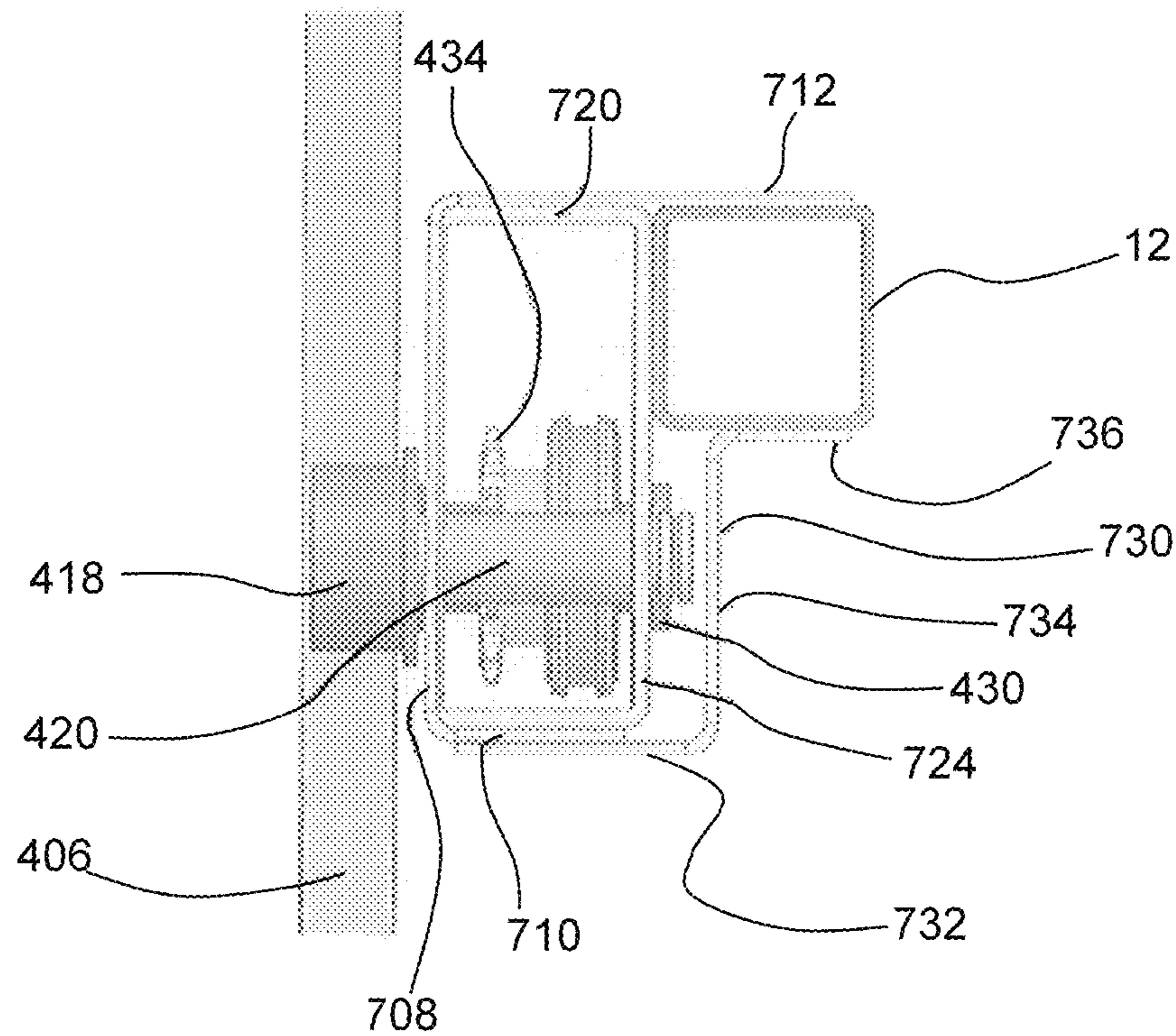
FIG. 7E



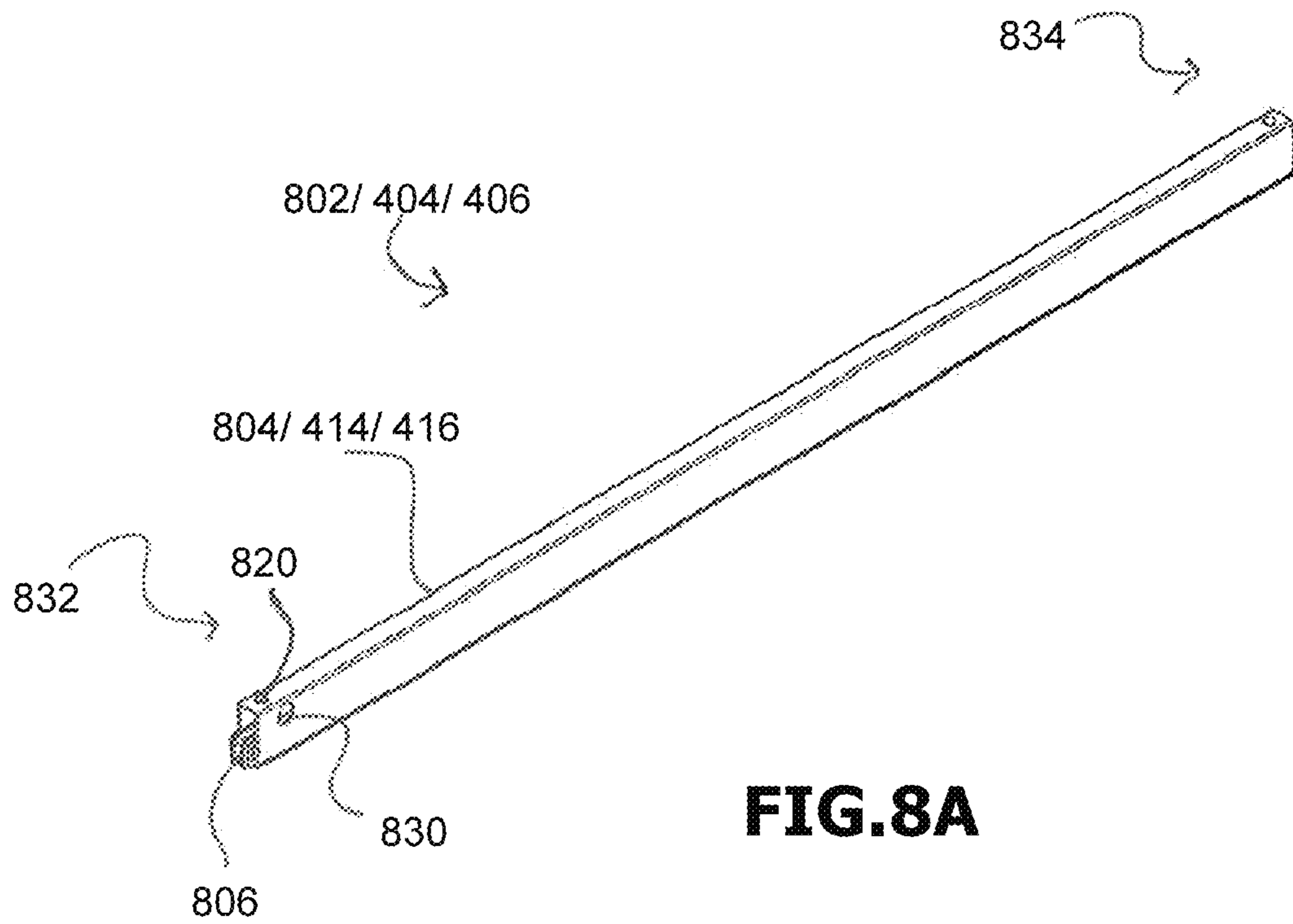




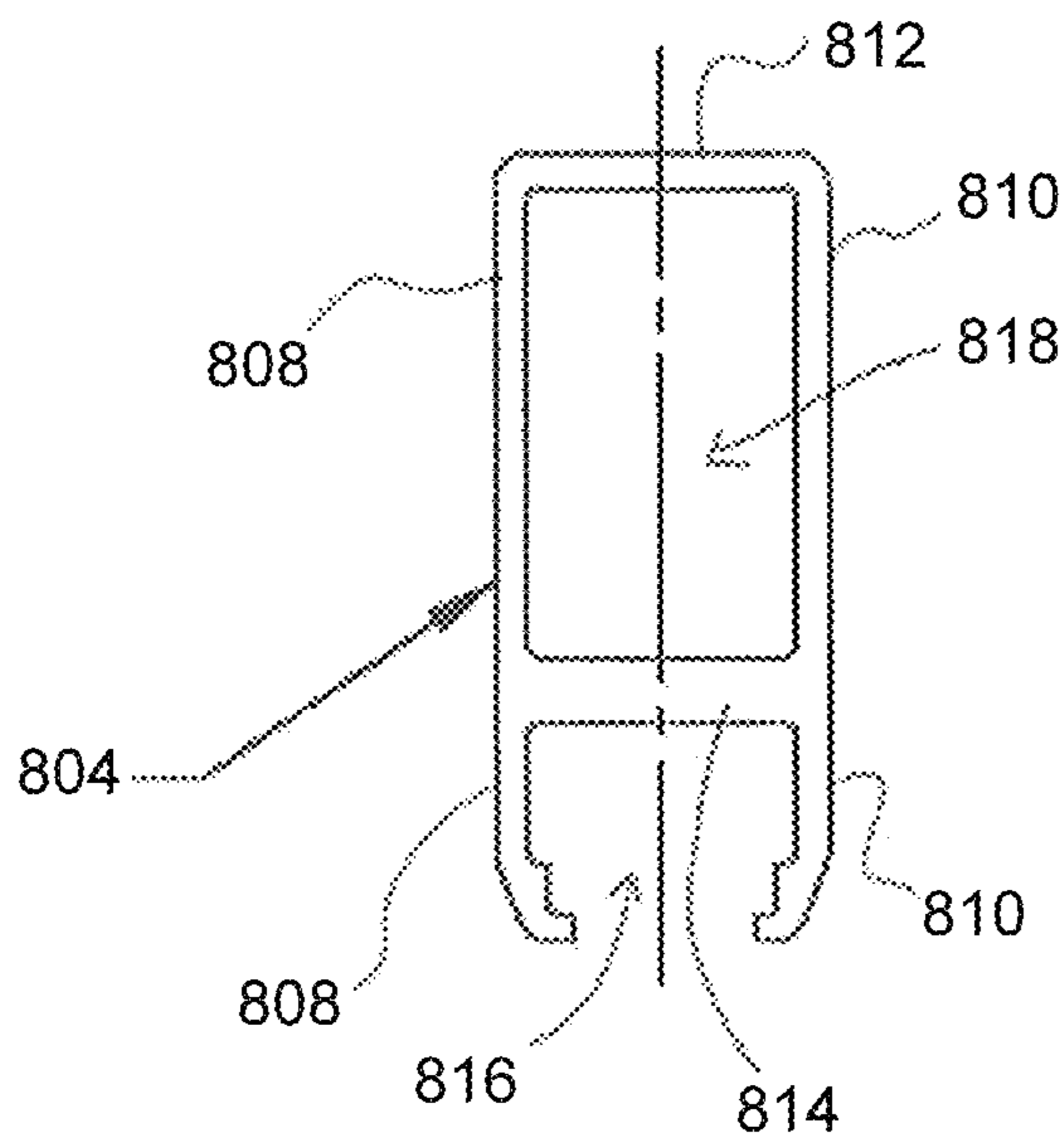
**FIG. 7G**



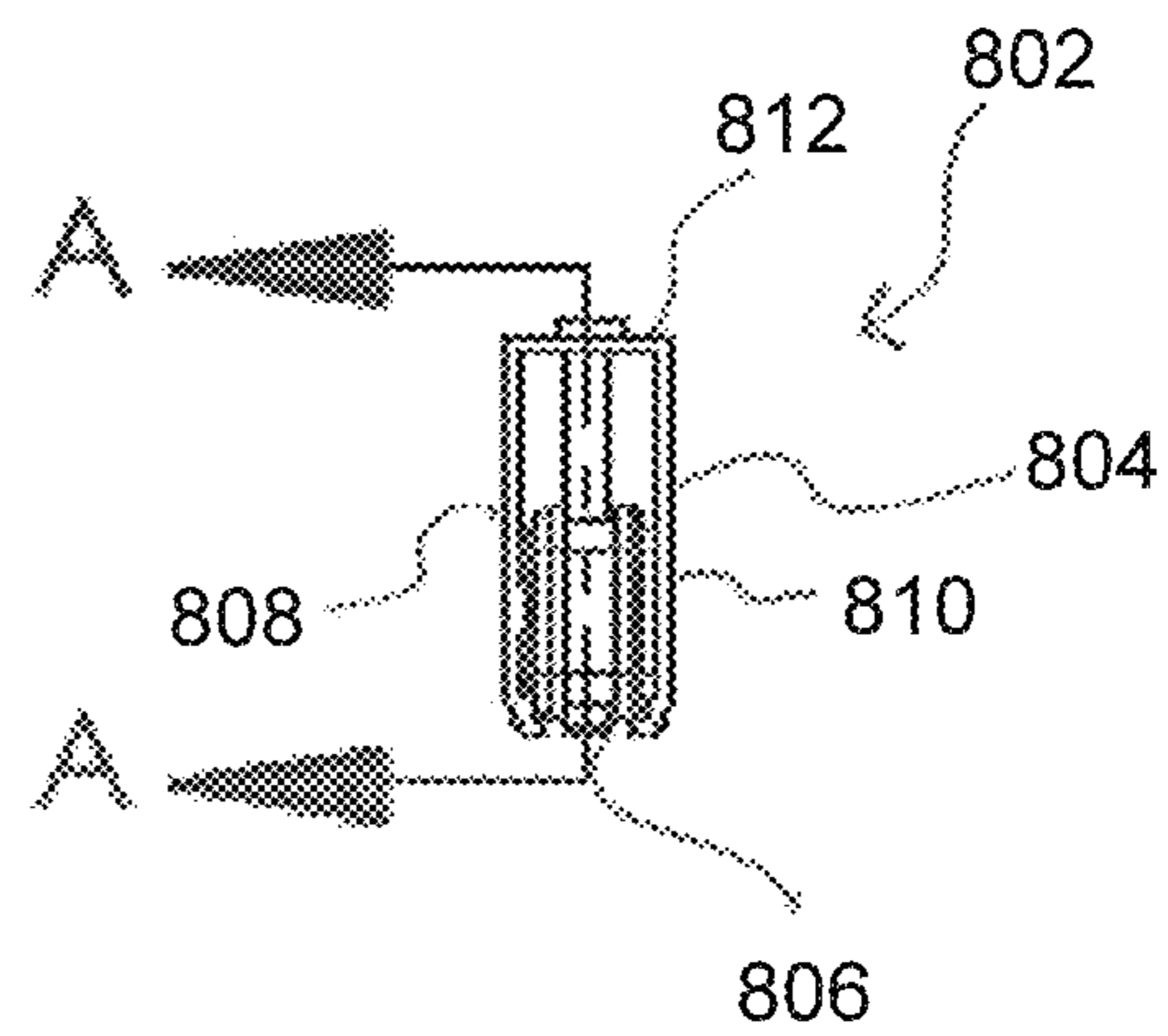
**FIG. 7H**



**FIG. 8A**

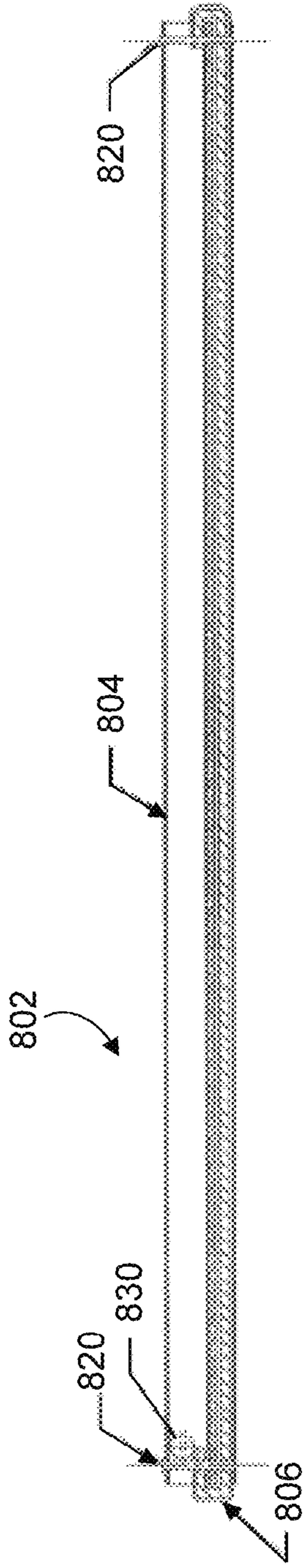


**FIG. 8B**

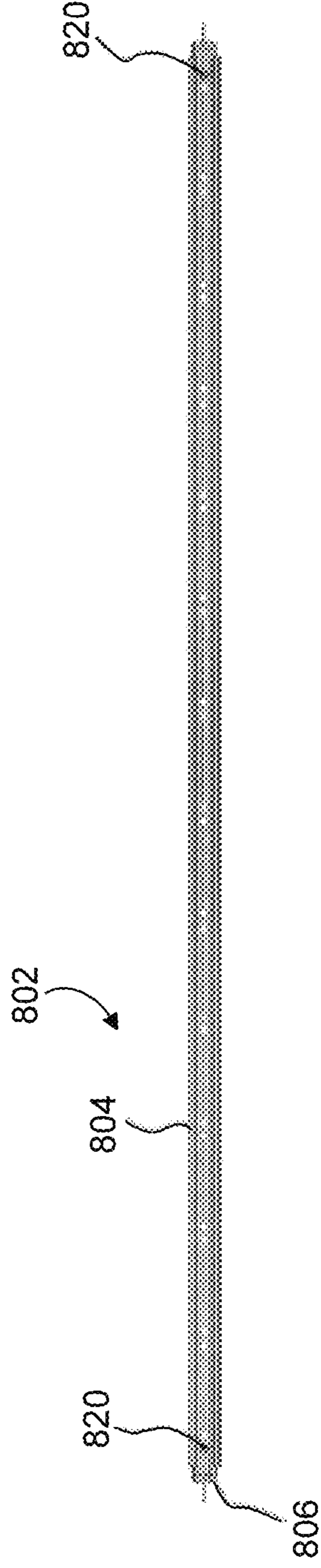


**FIG. 8C**

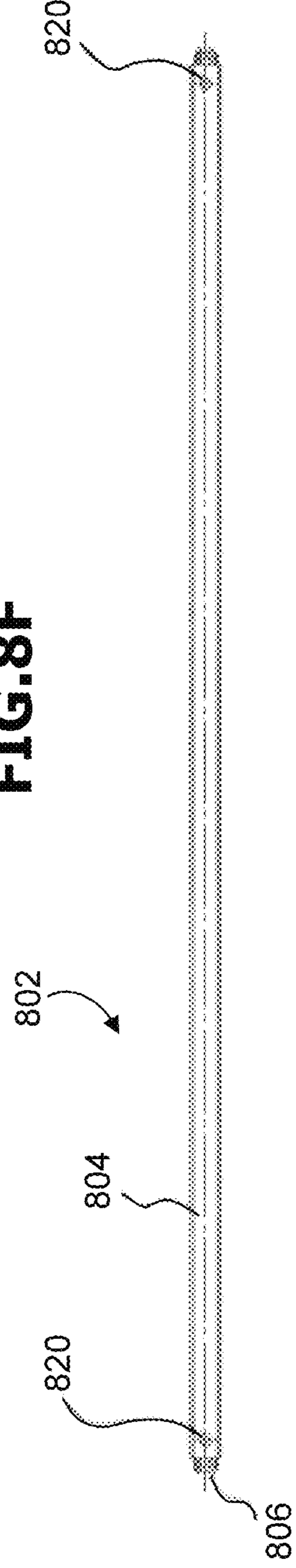




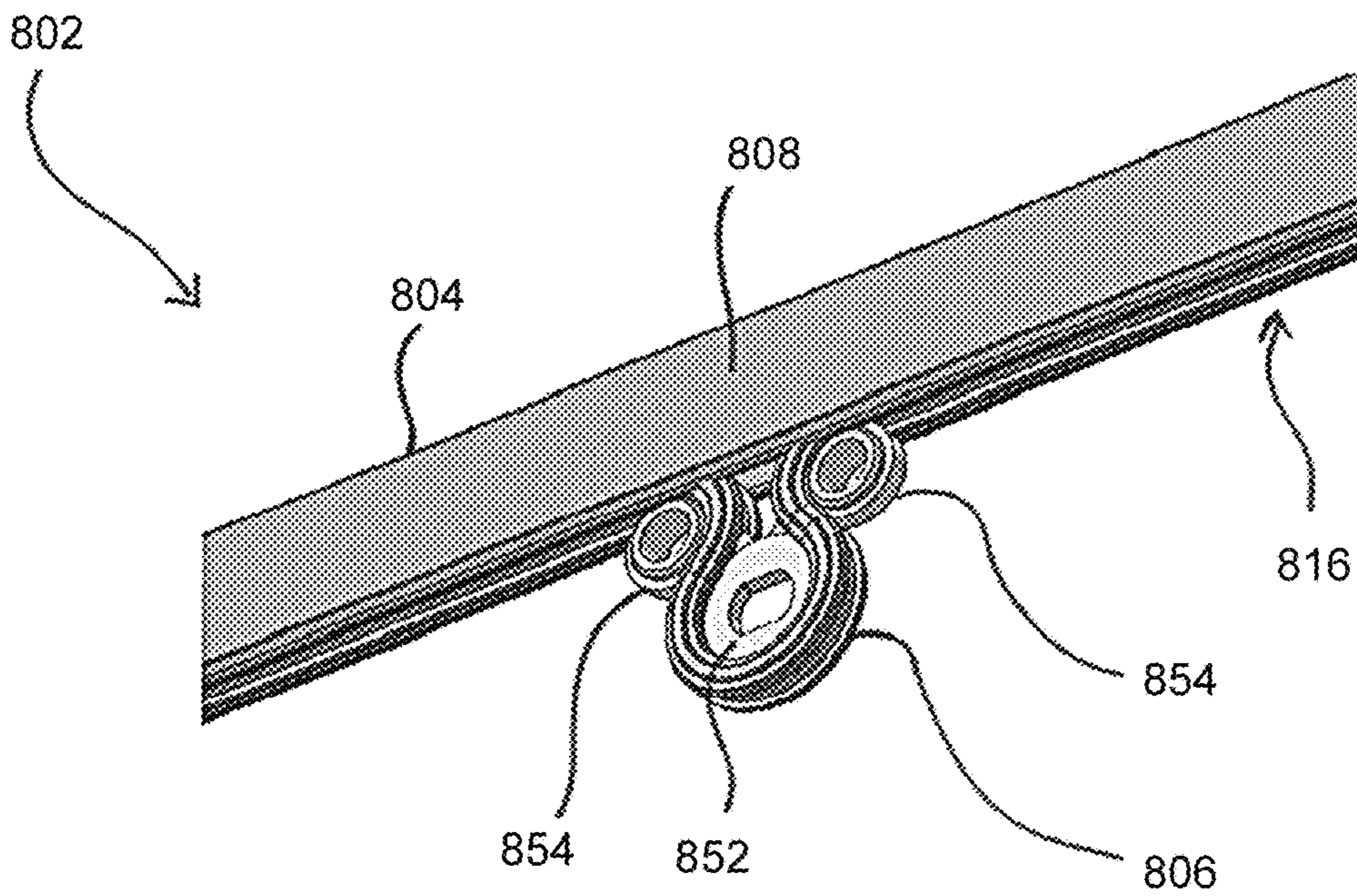
**FIG. 8D**



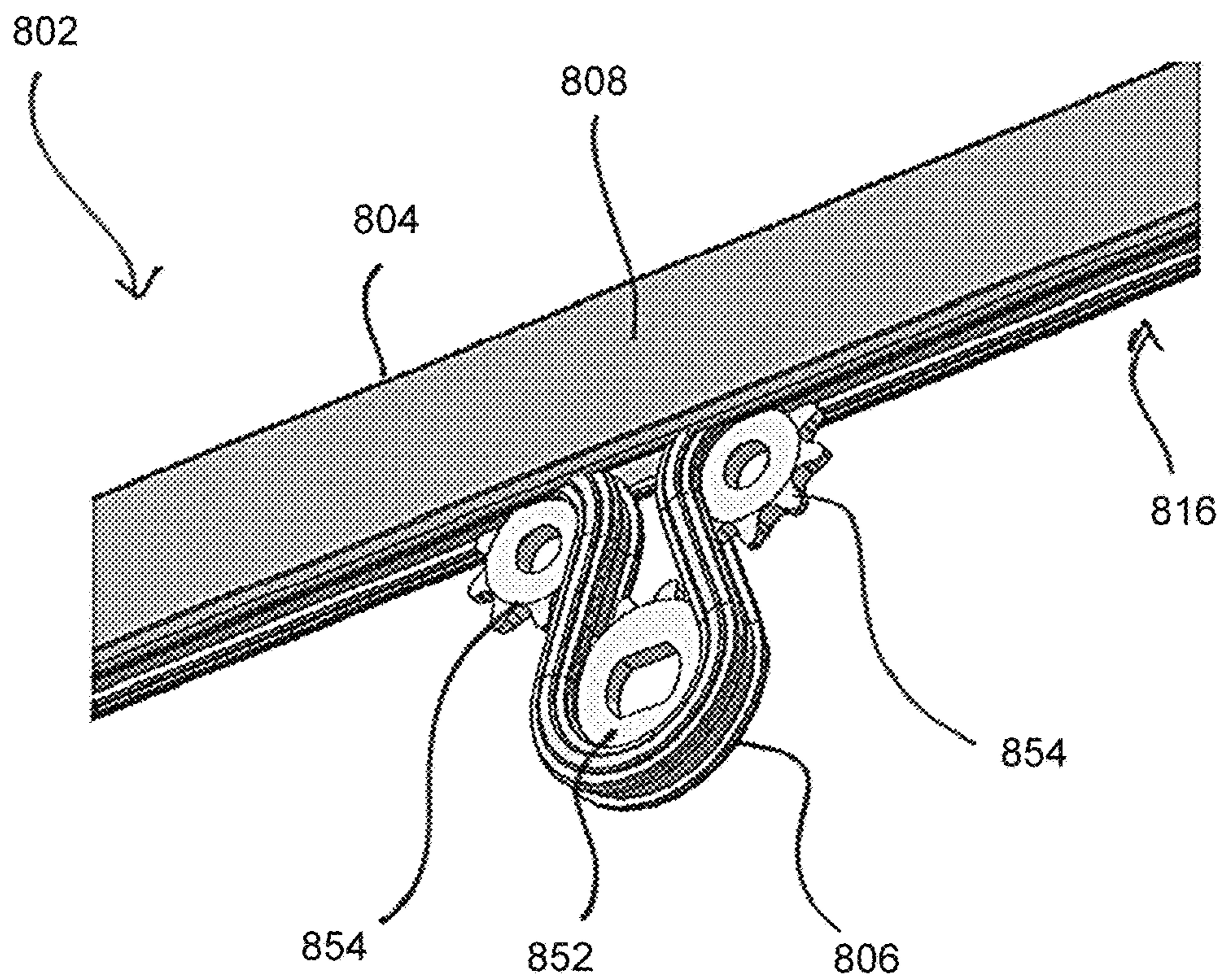
**FIG. 8E**



**FIG. 8F**

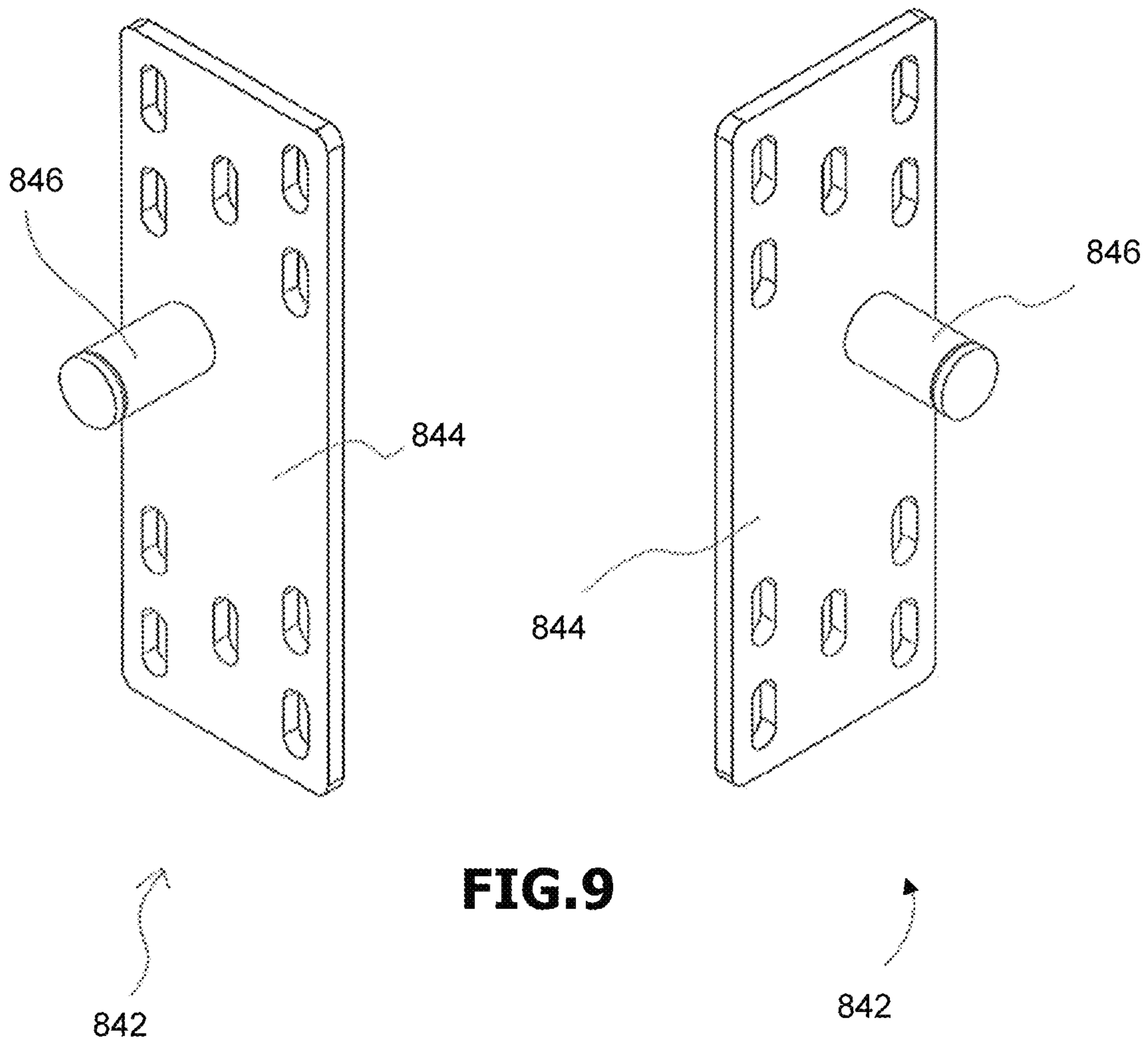


**FIG. 8G**



**FIG. 8H**







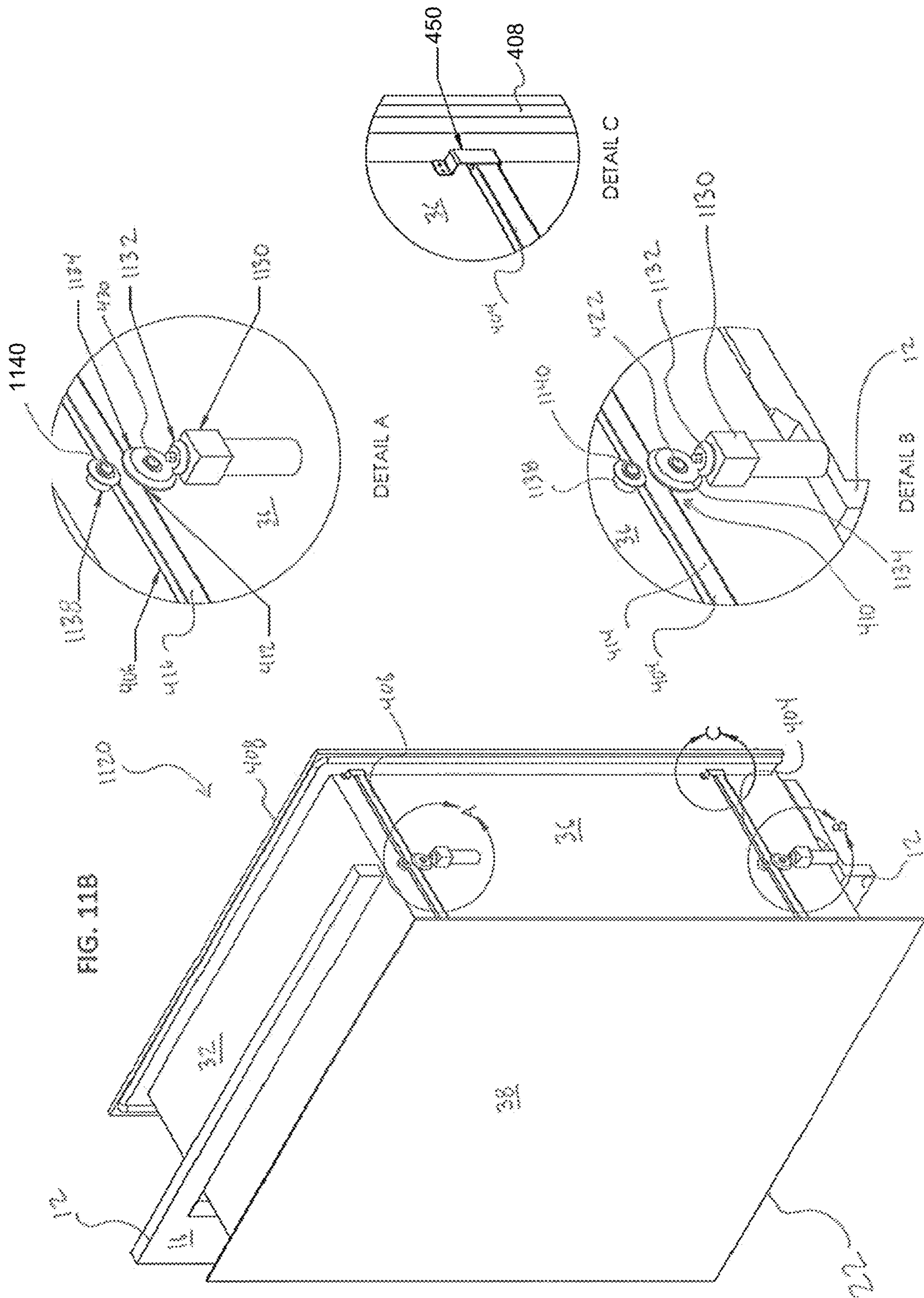














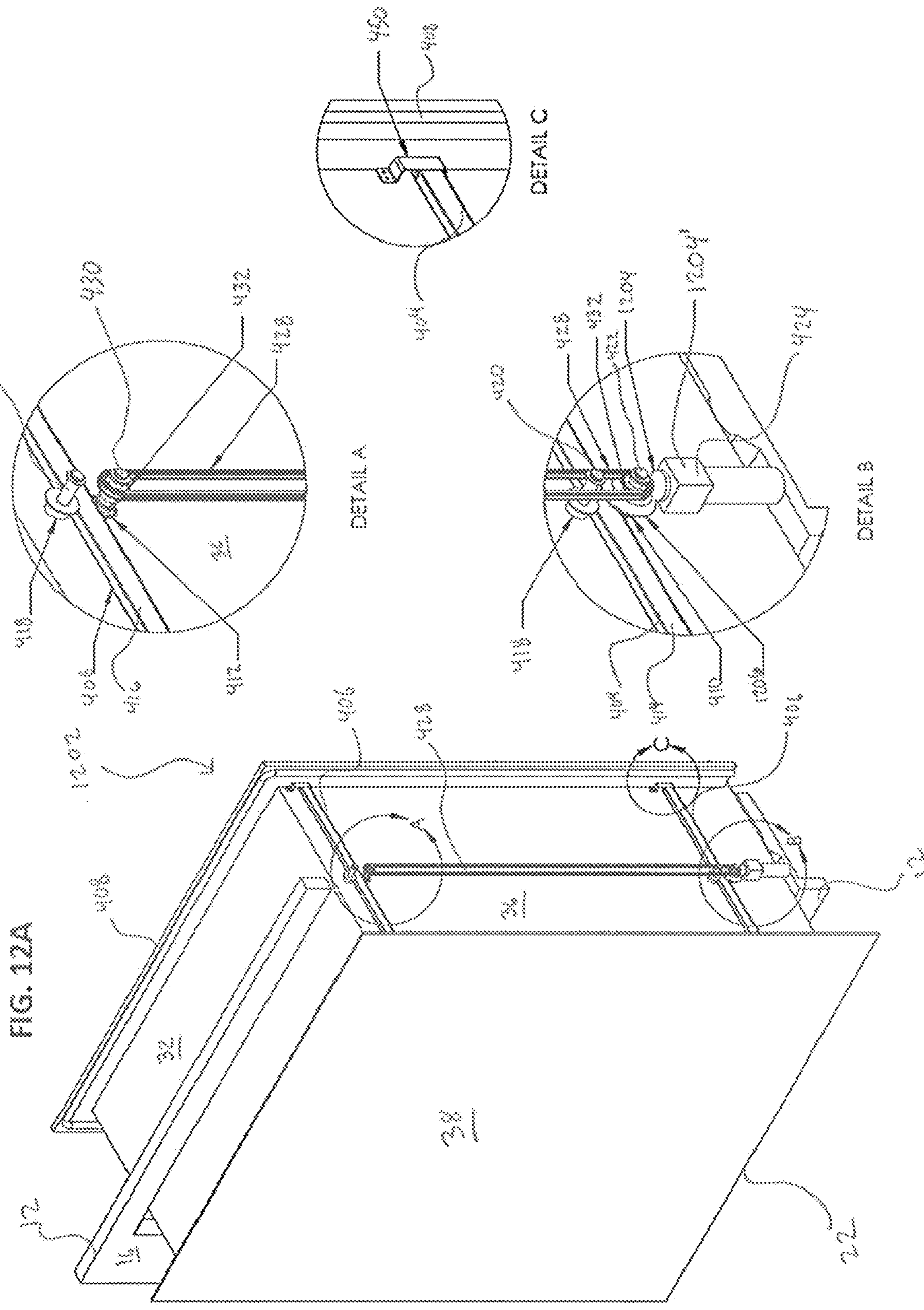
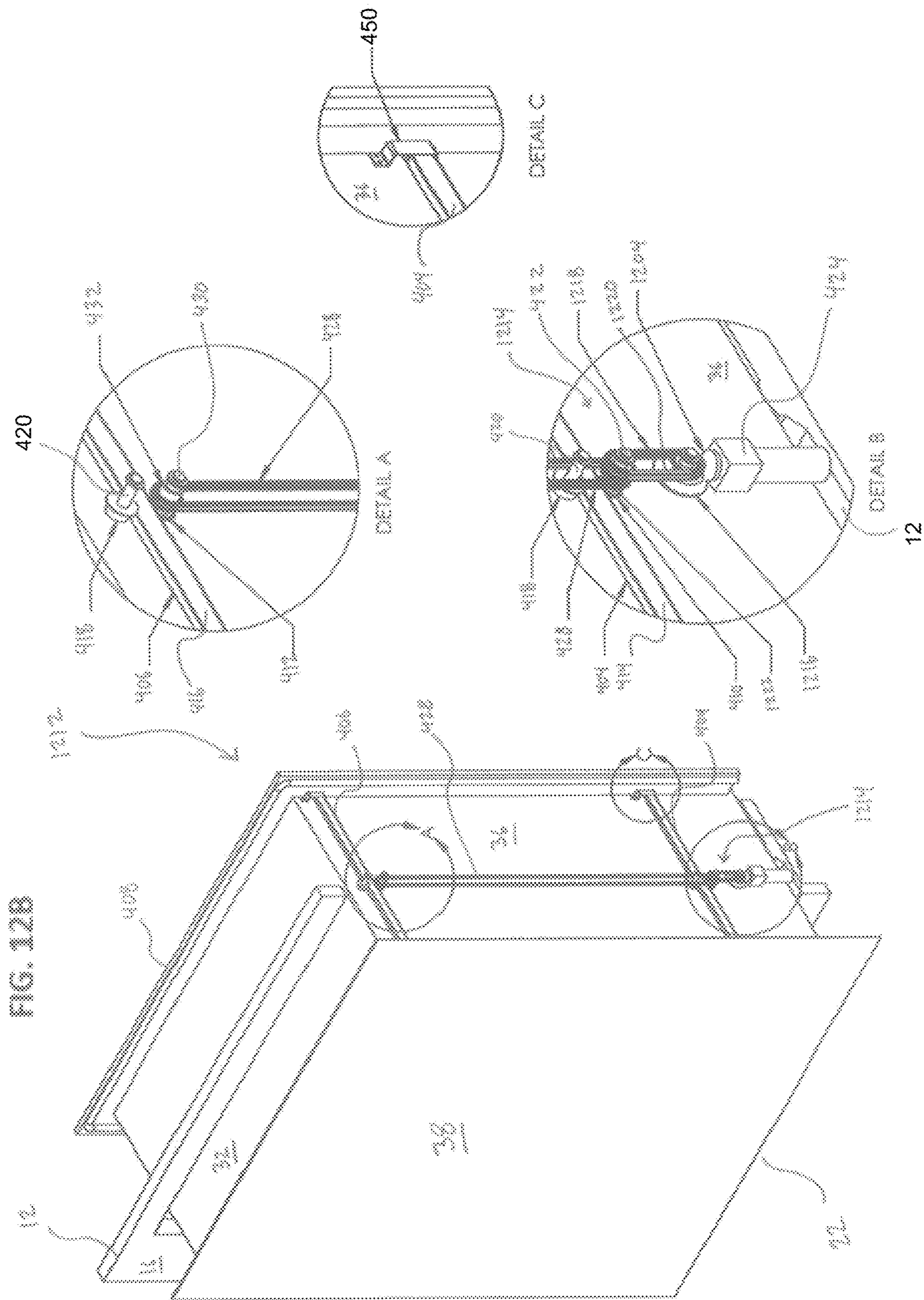
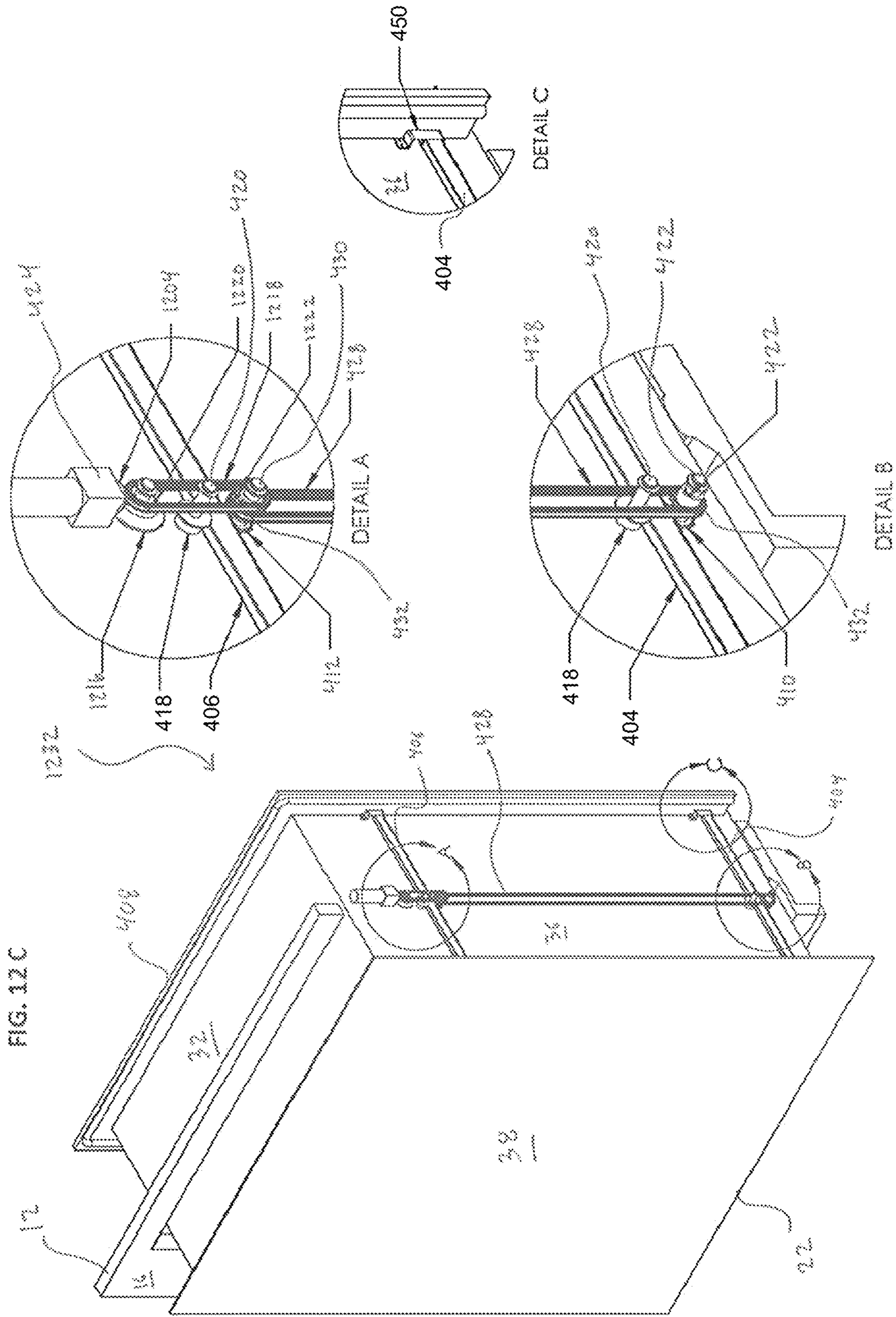
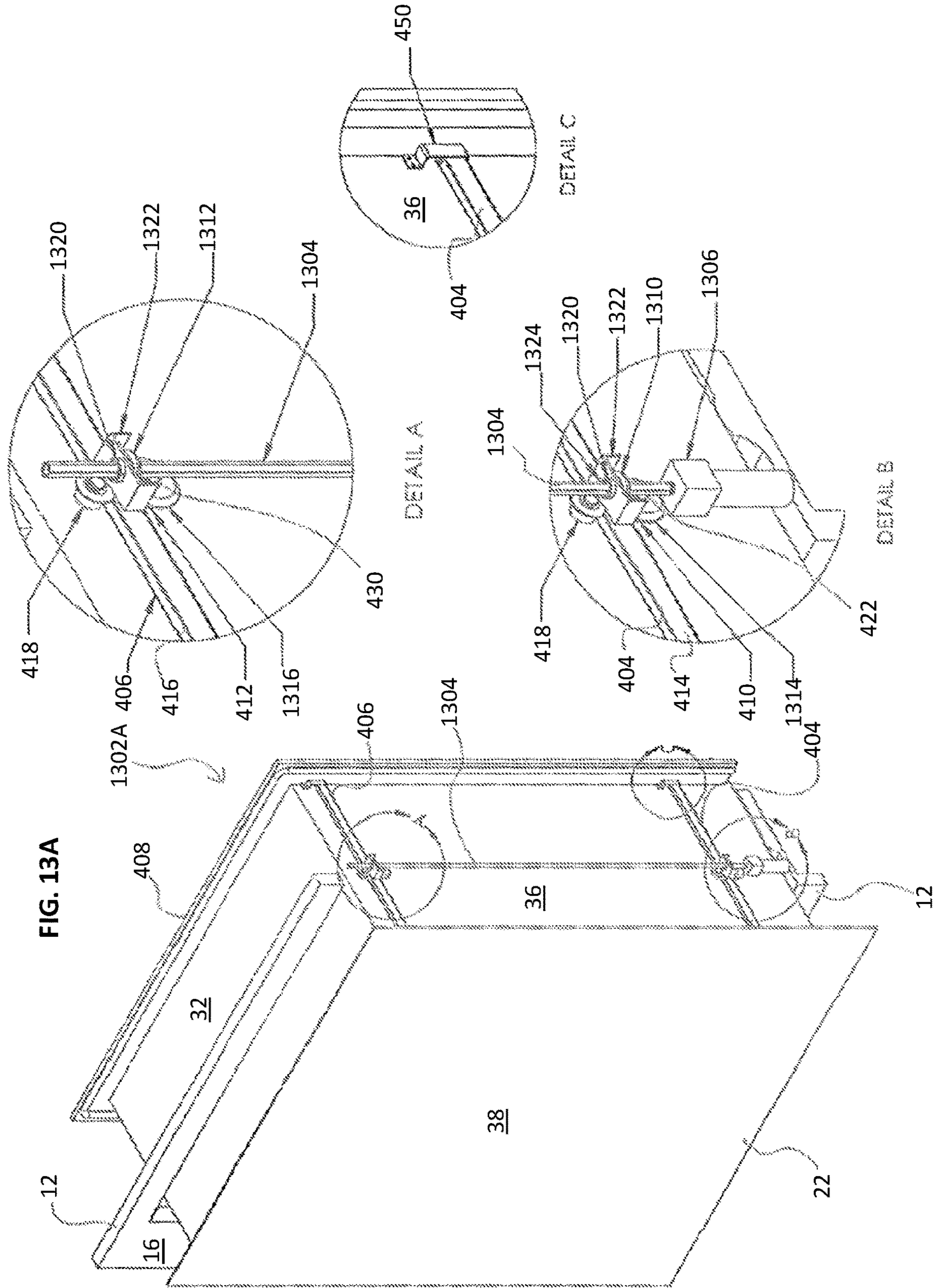


FIG. 12A













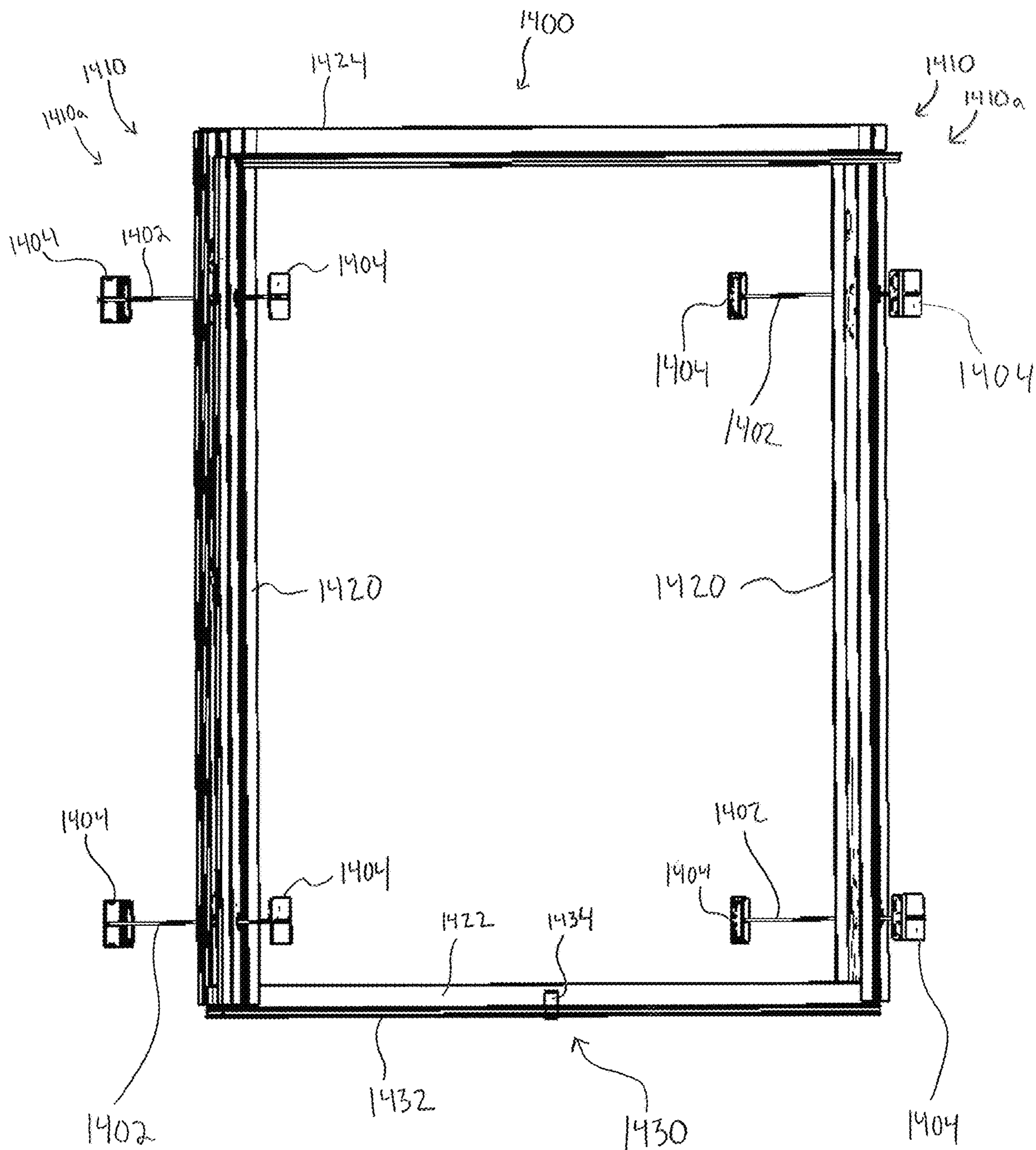


FIG. 14



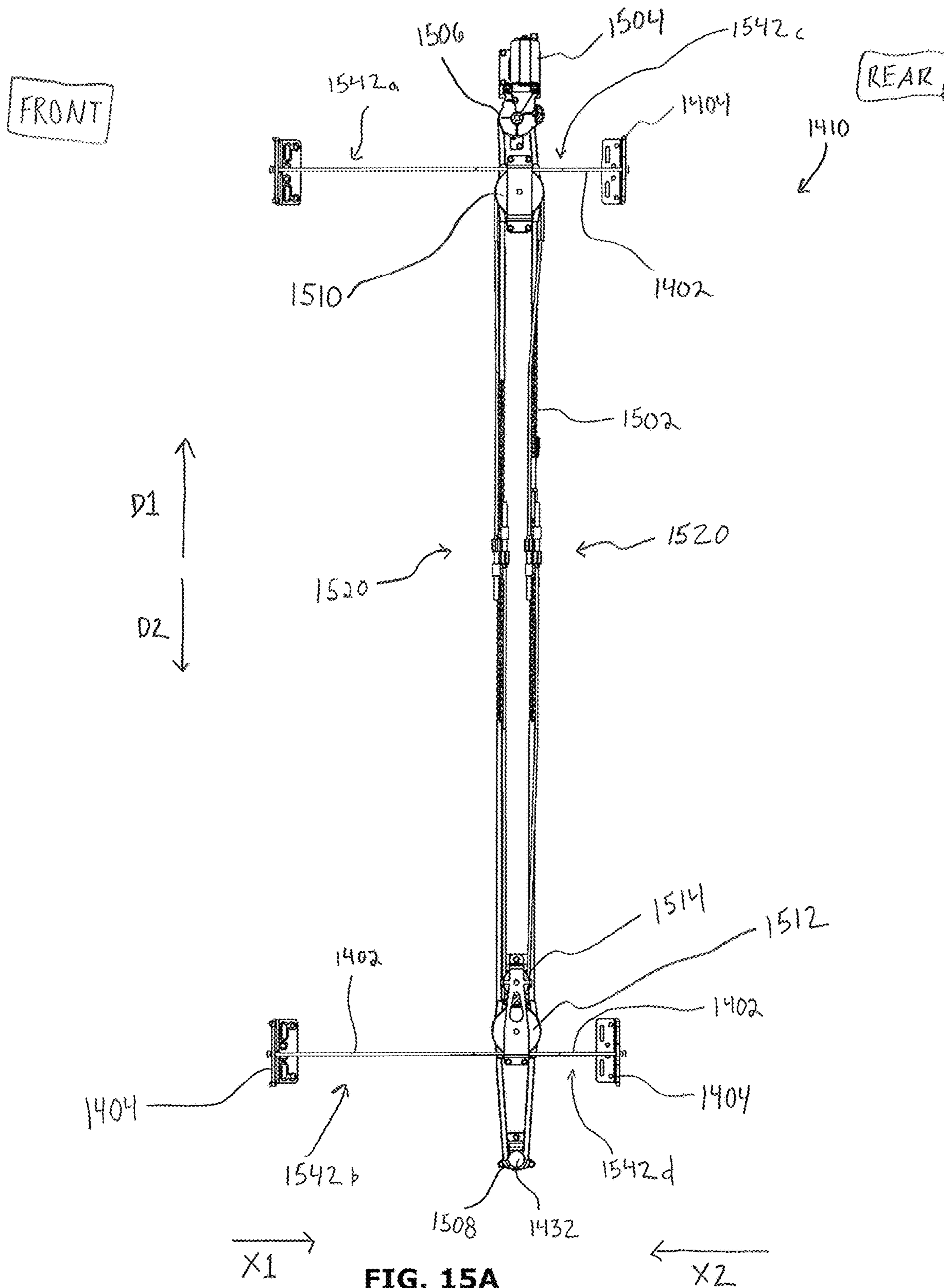


FIG. 15A

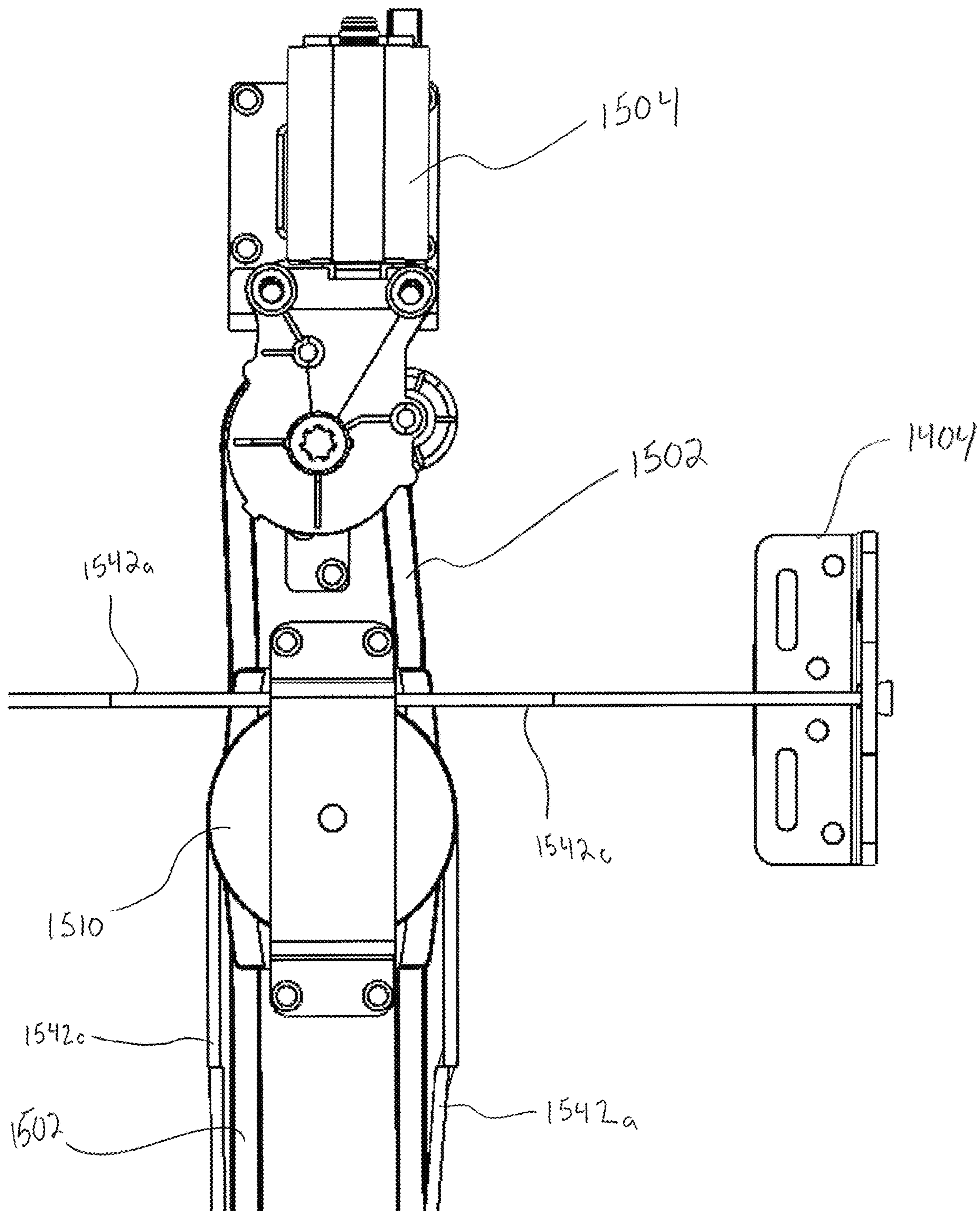


FIG. 15B



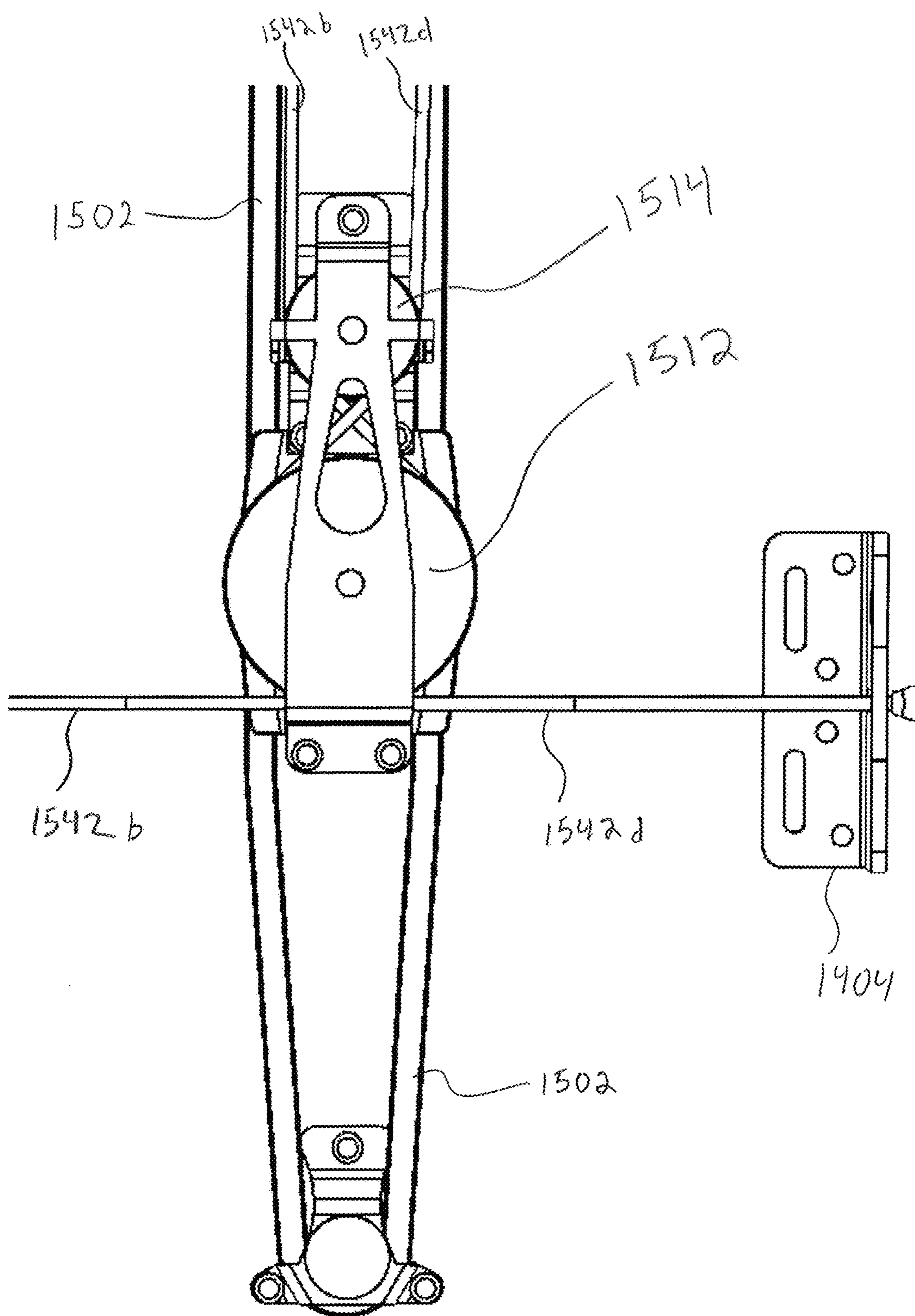


FIG. 15C

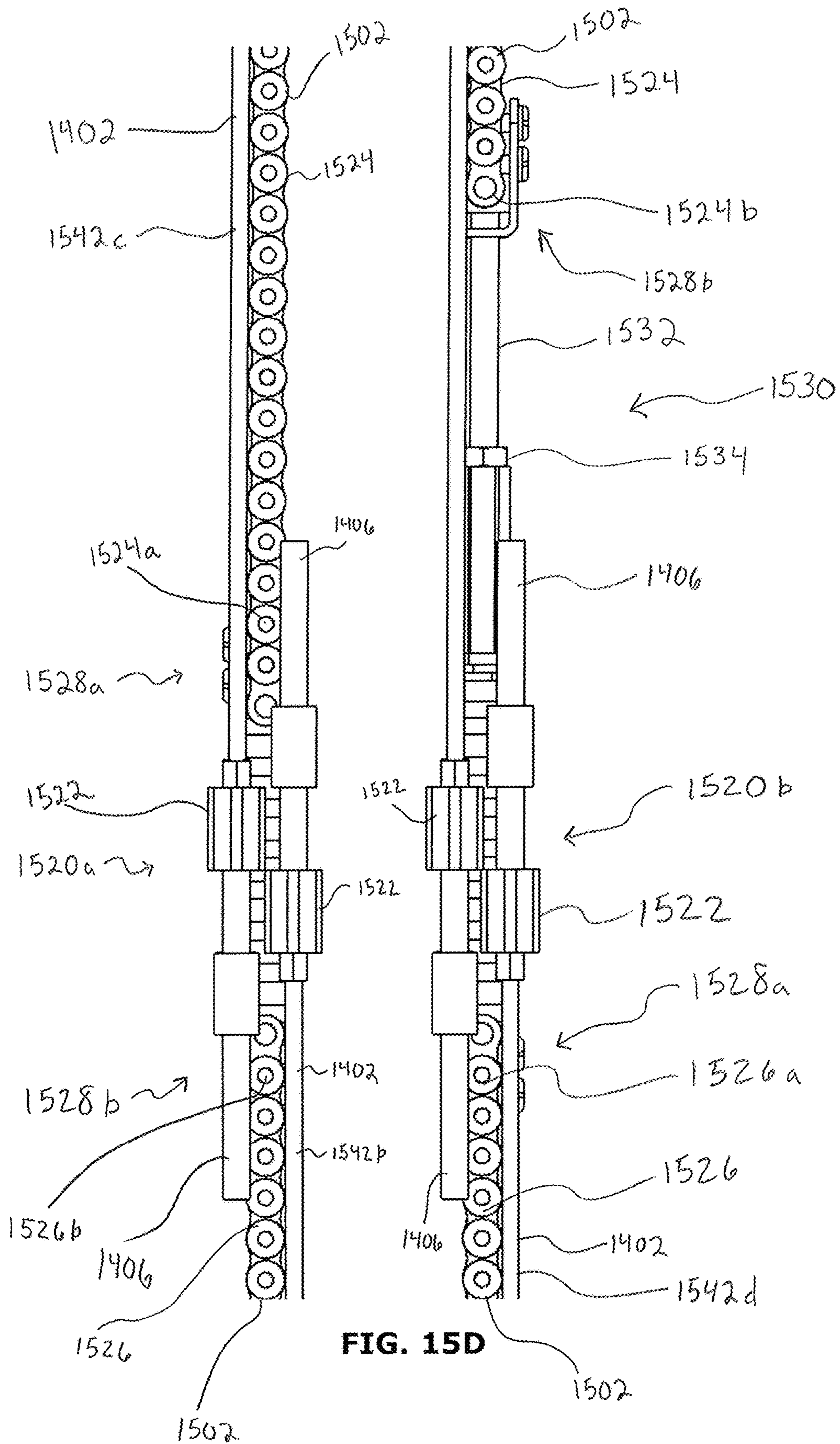


FIG. 15D



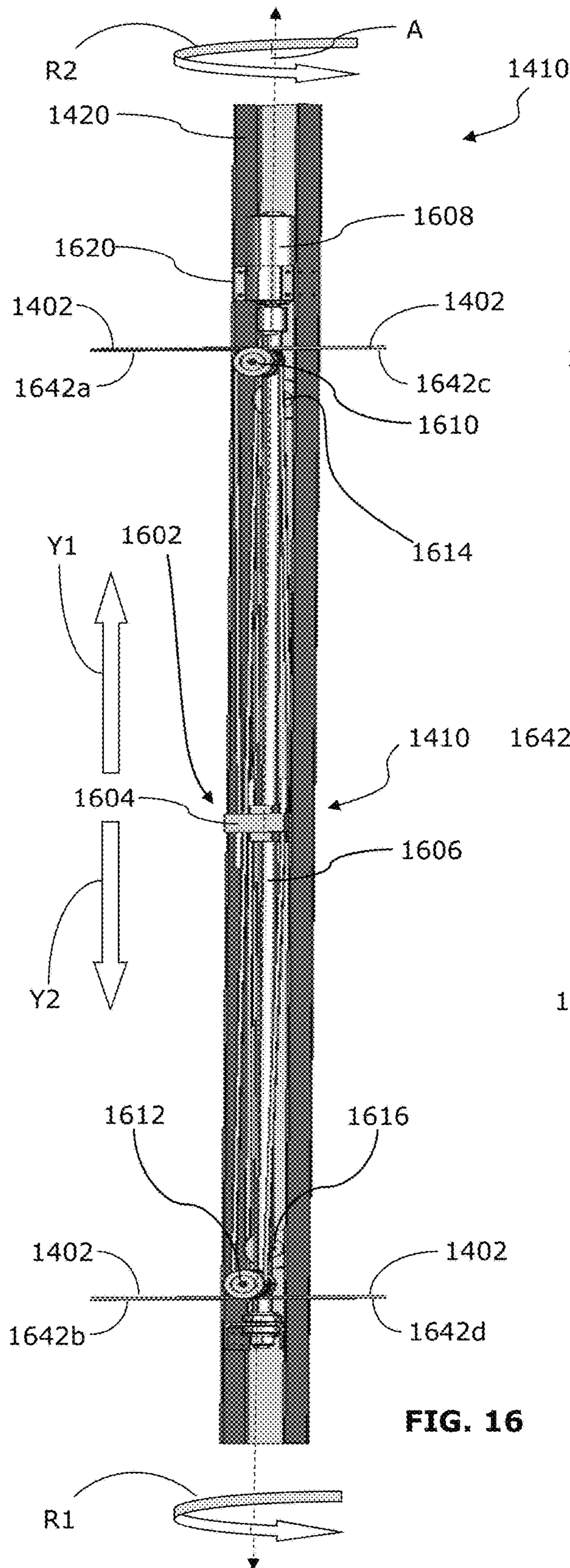


FIG. 16

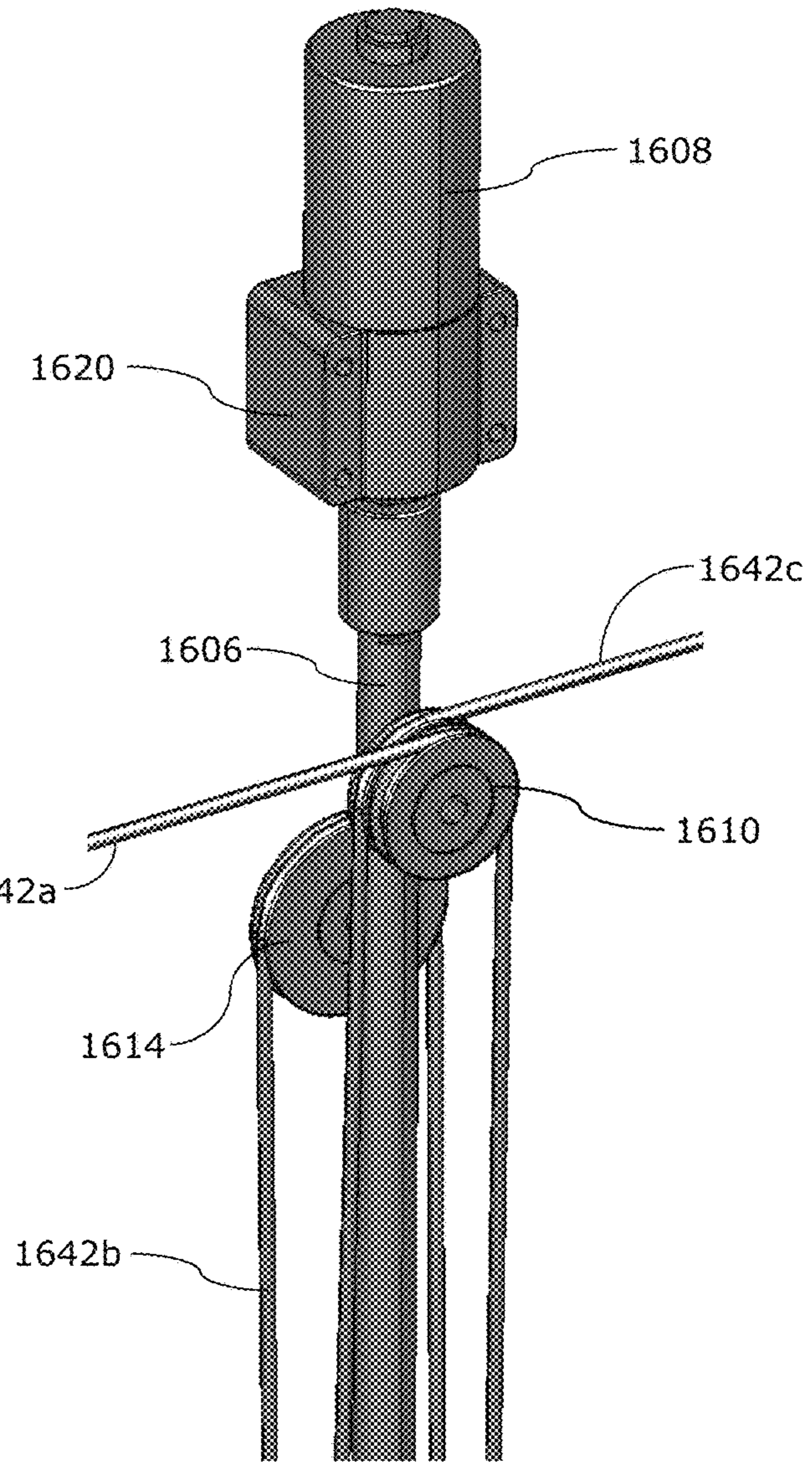


FIG. 17A



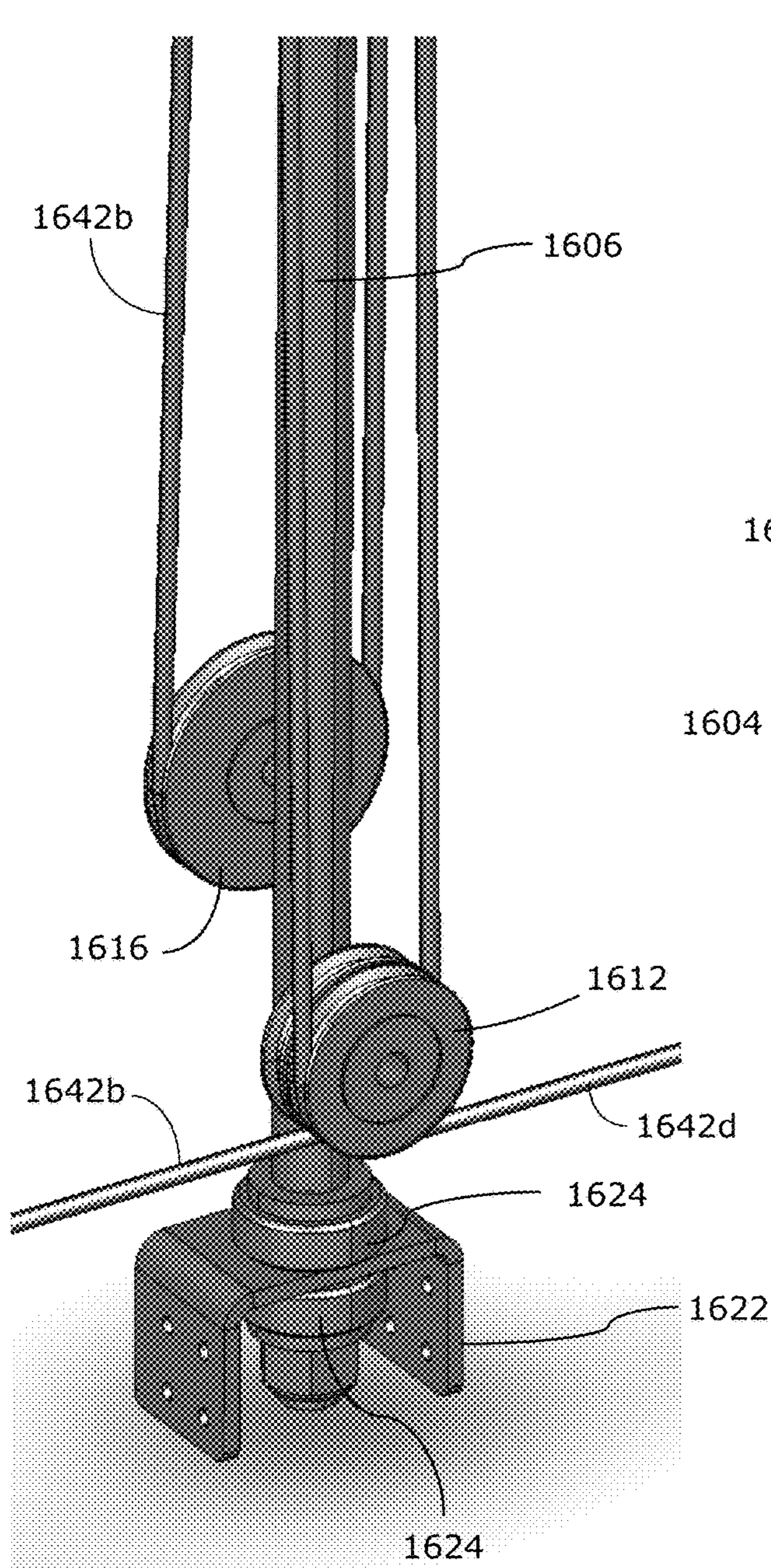


FIG. 17B

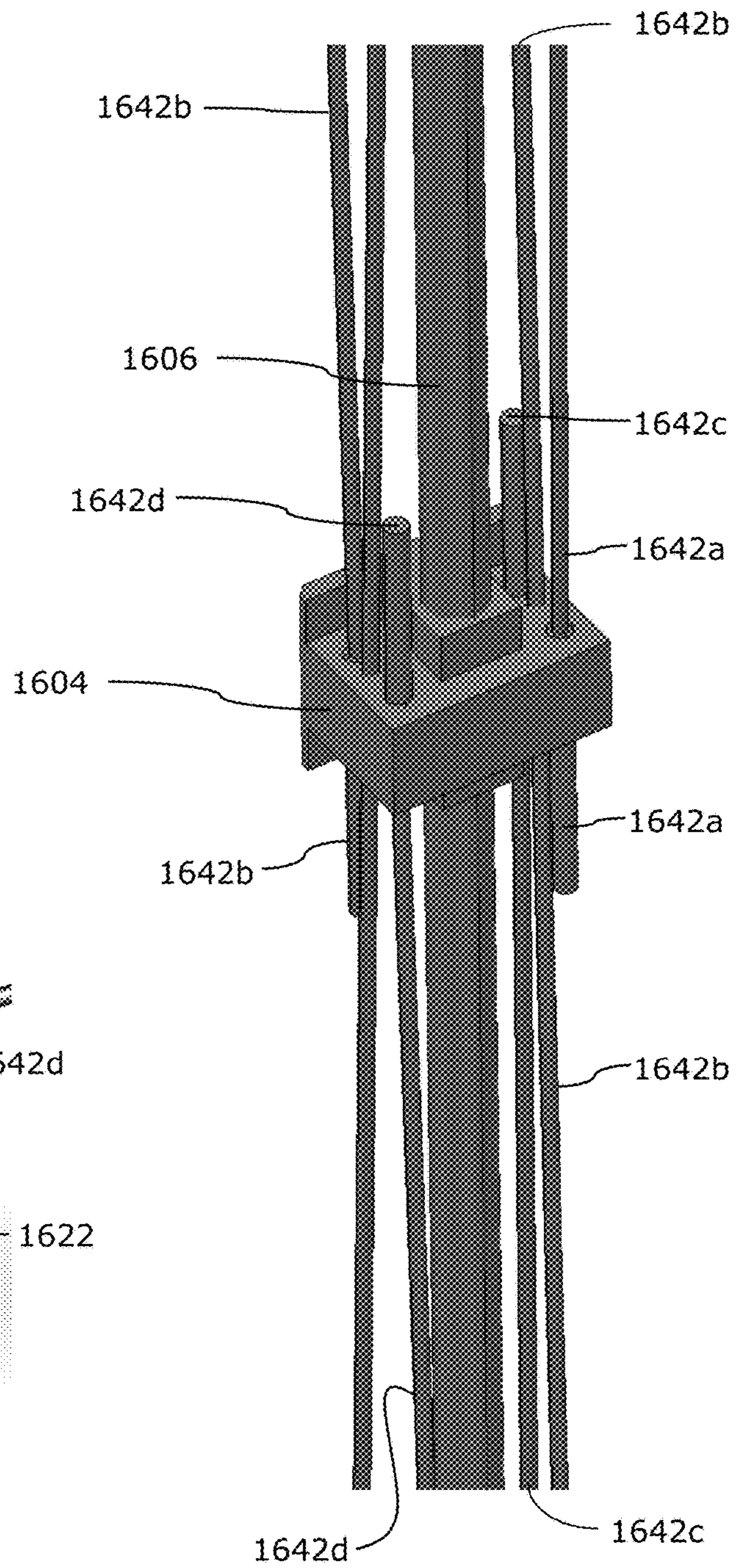
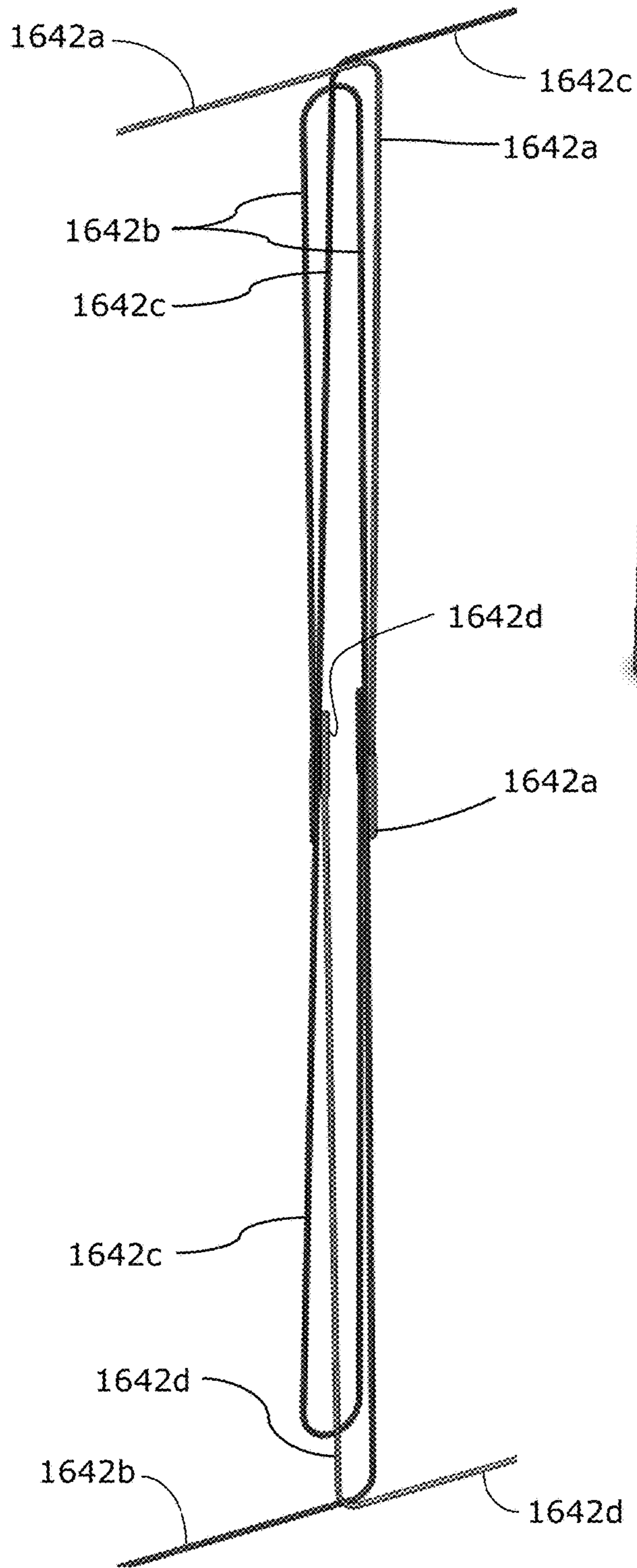
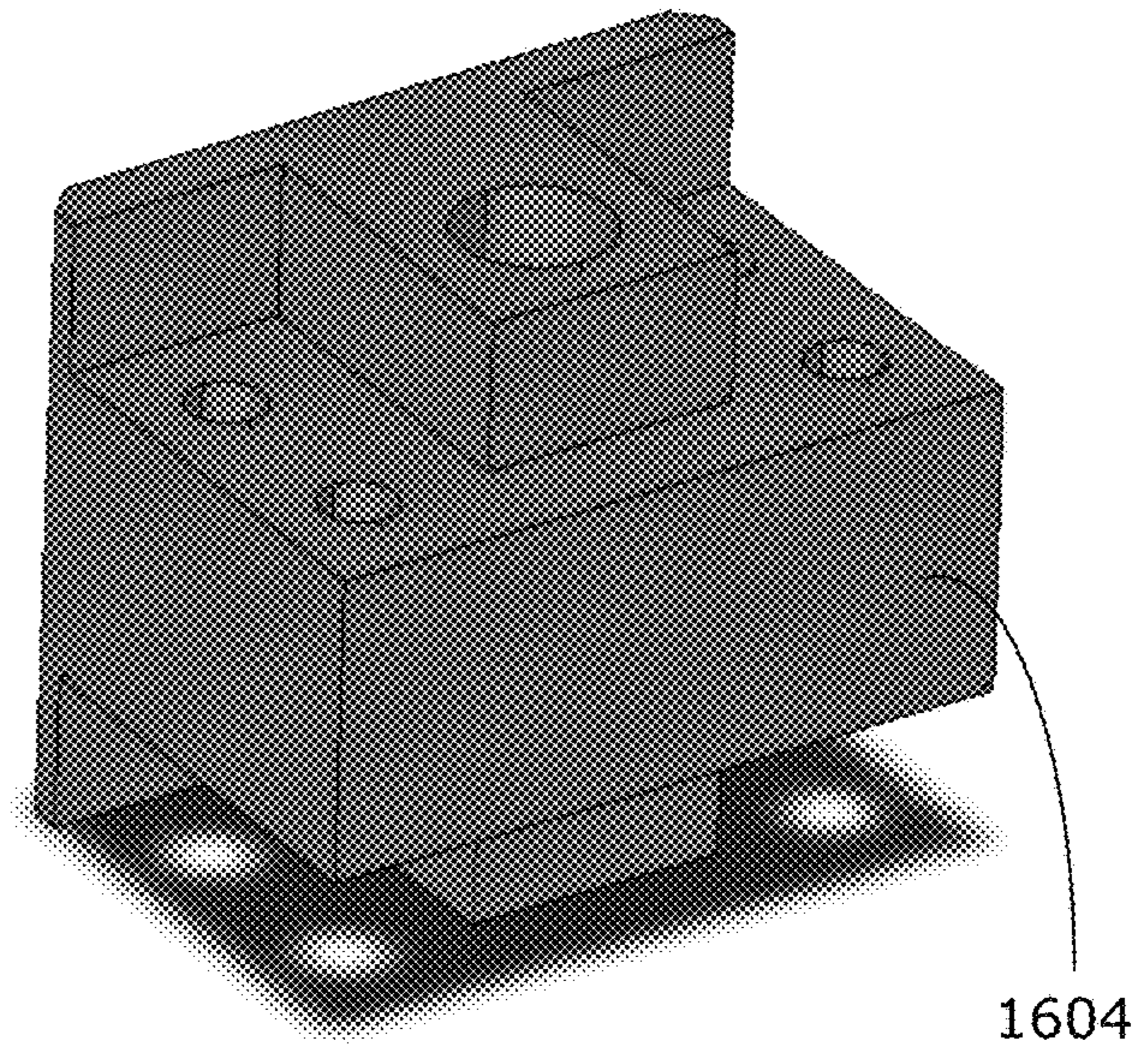


FIG. 17C



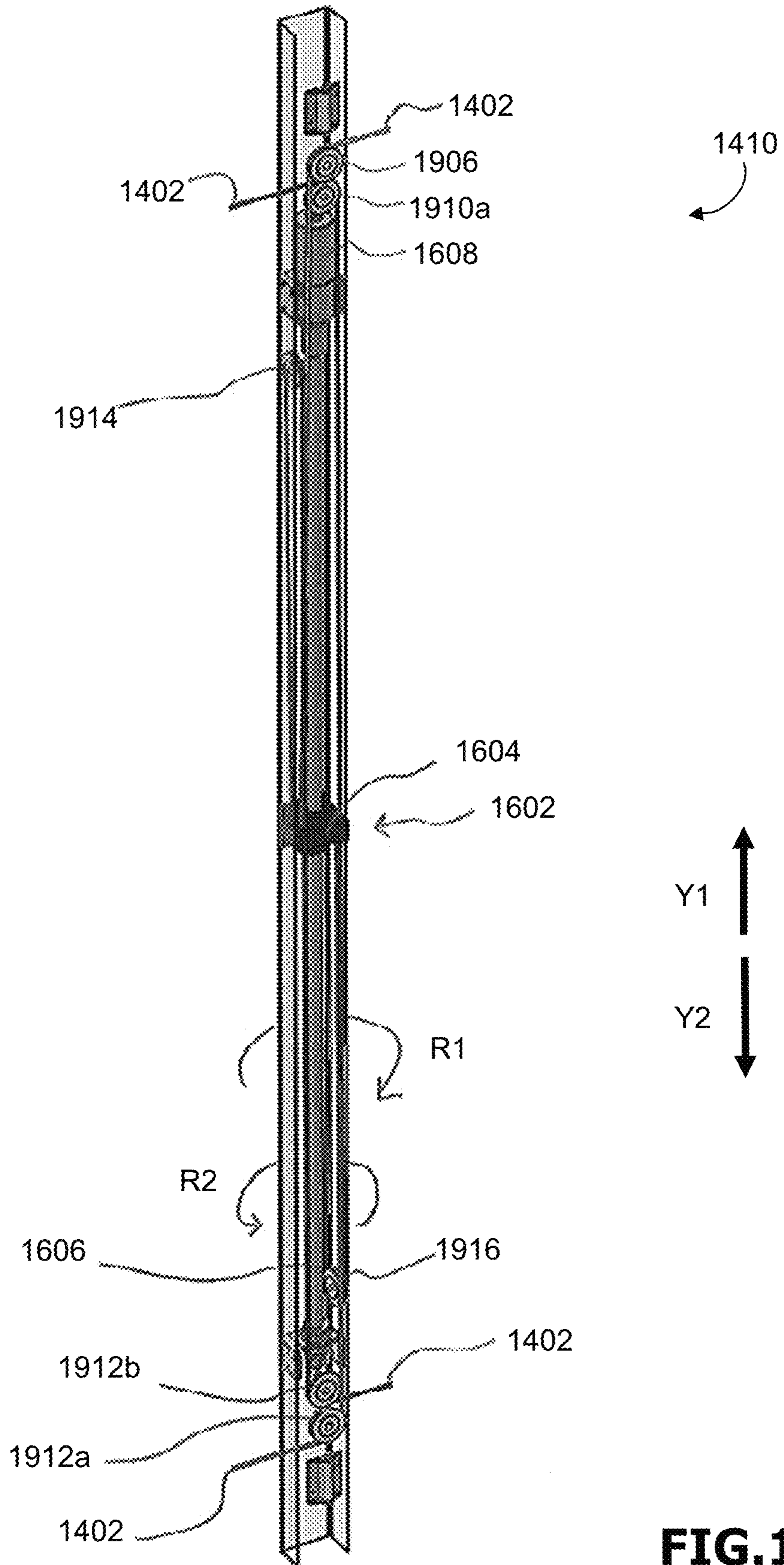


**FIG. 18A**



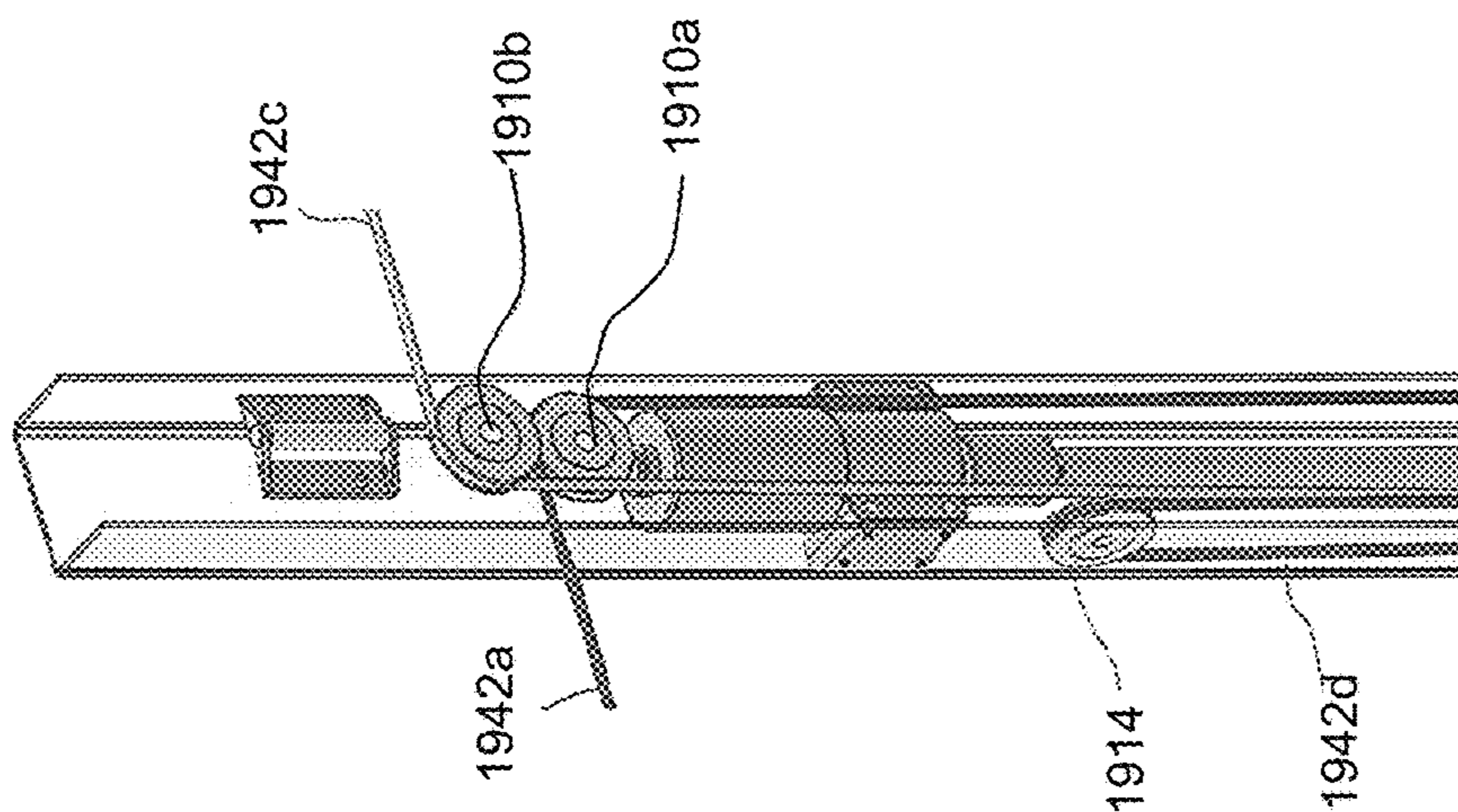
**FIG. 18B**

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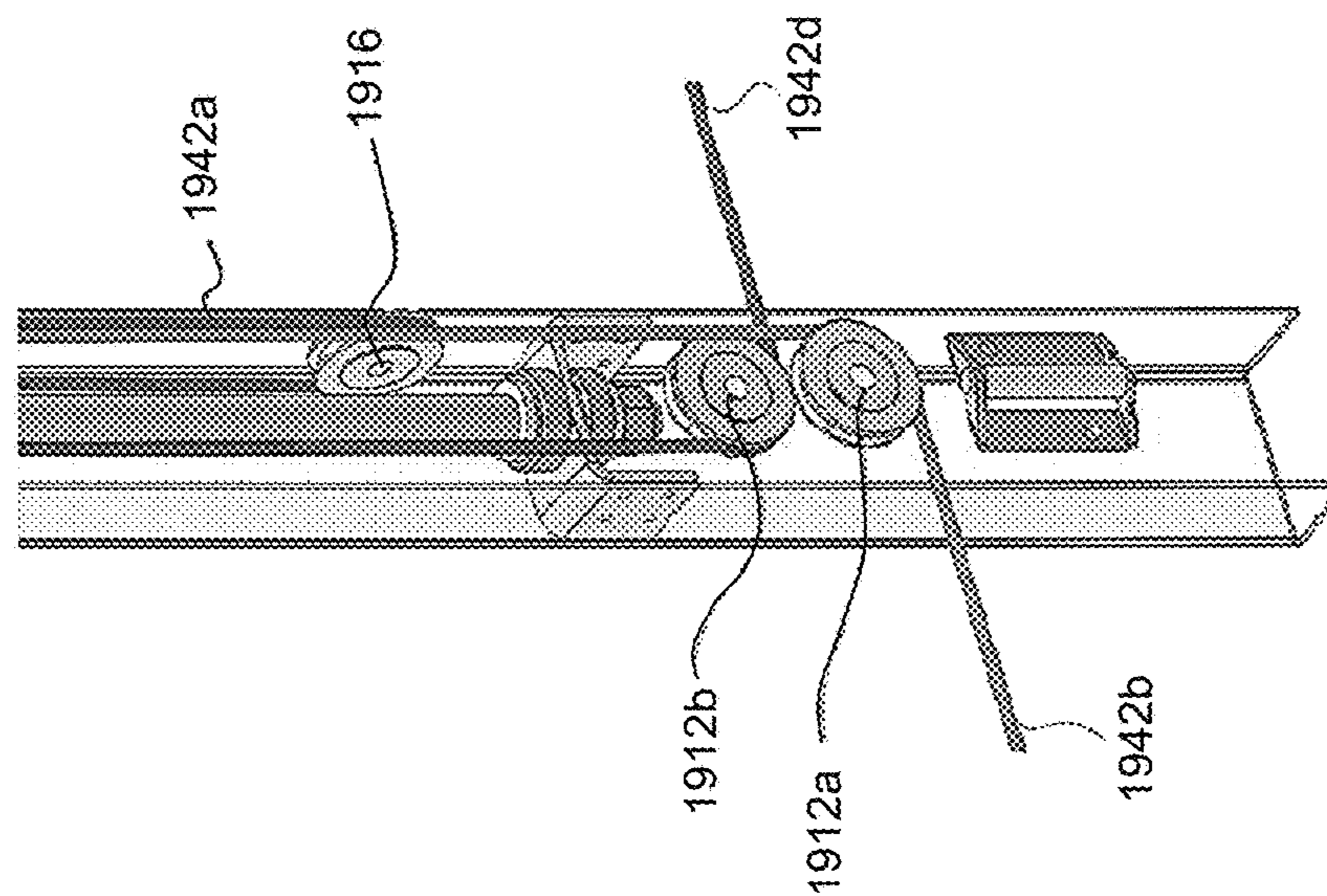


**FIG. 19**

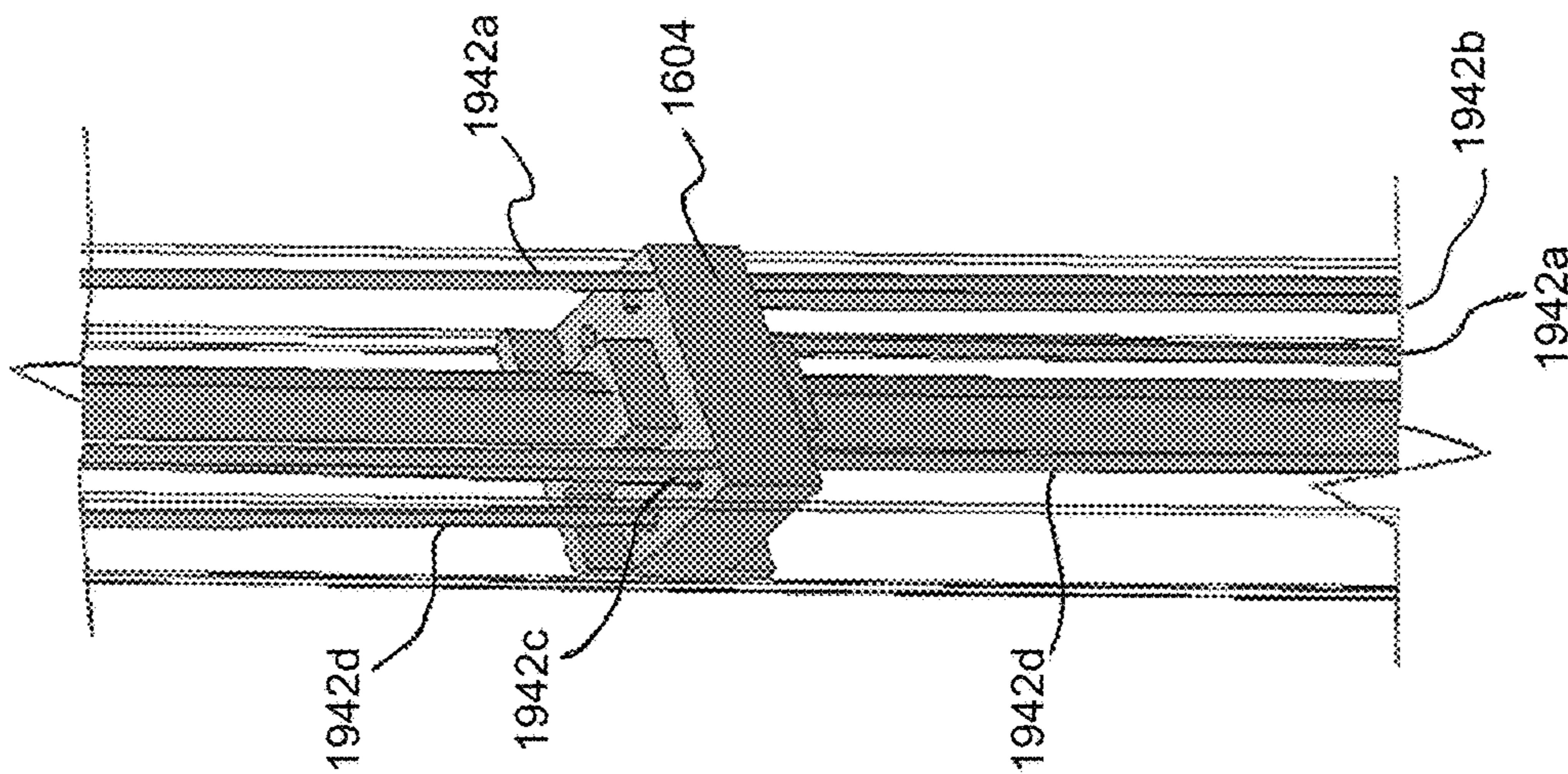




**FIG. 20A**

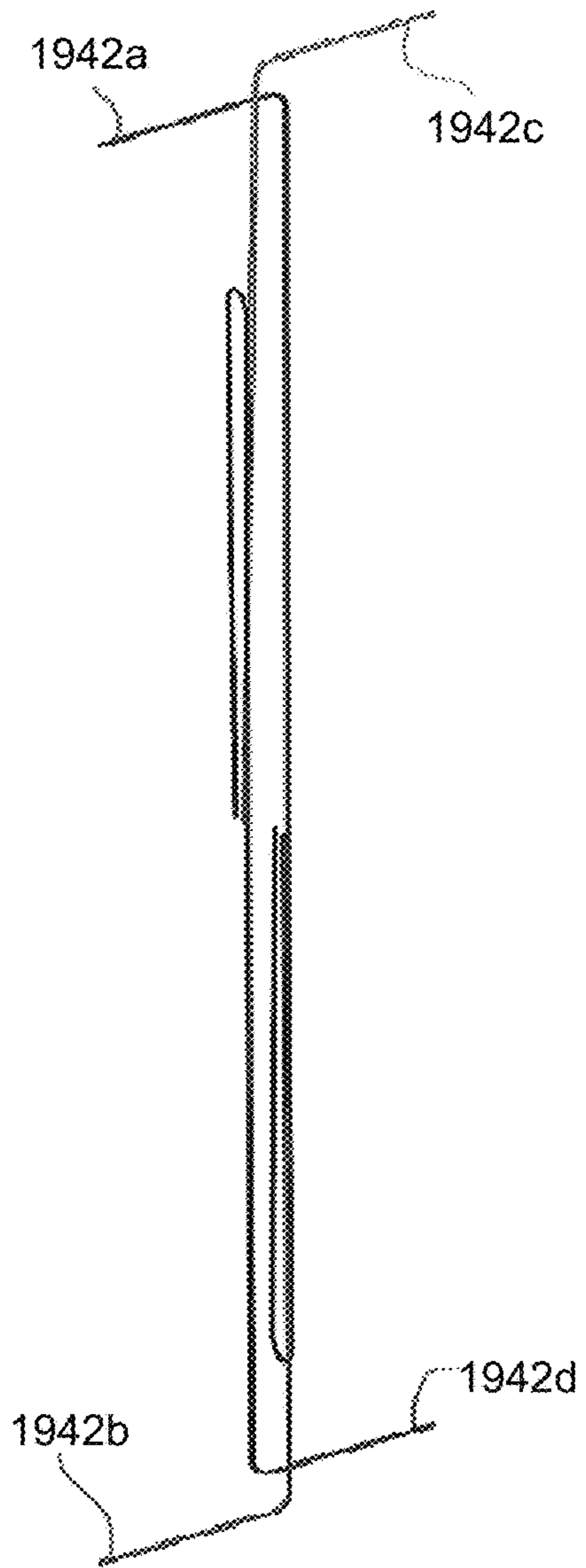


**FIG. 20B**

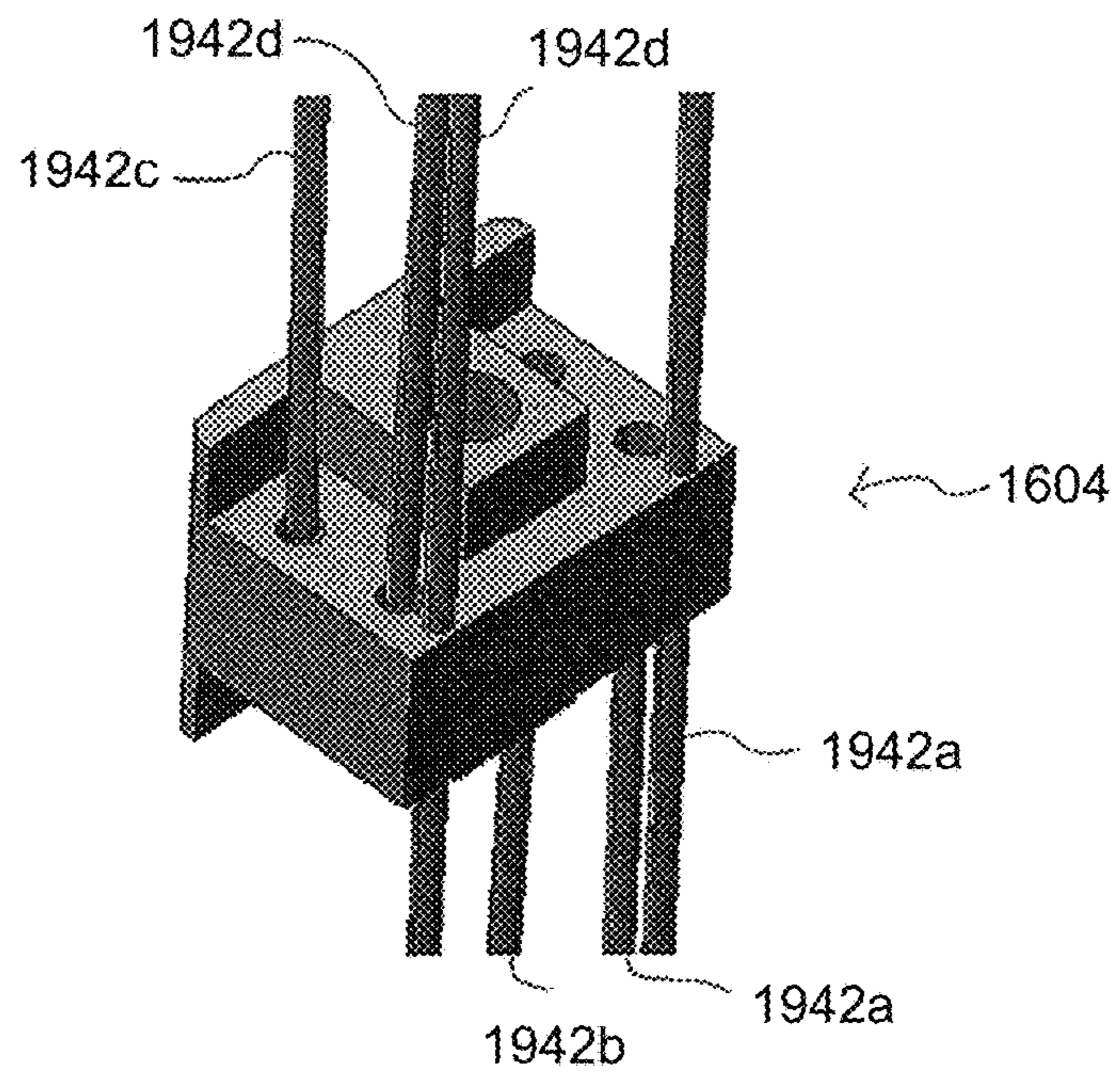


**FIG. 20C**

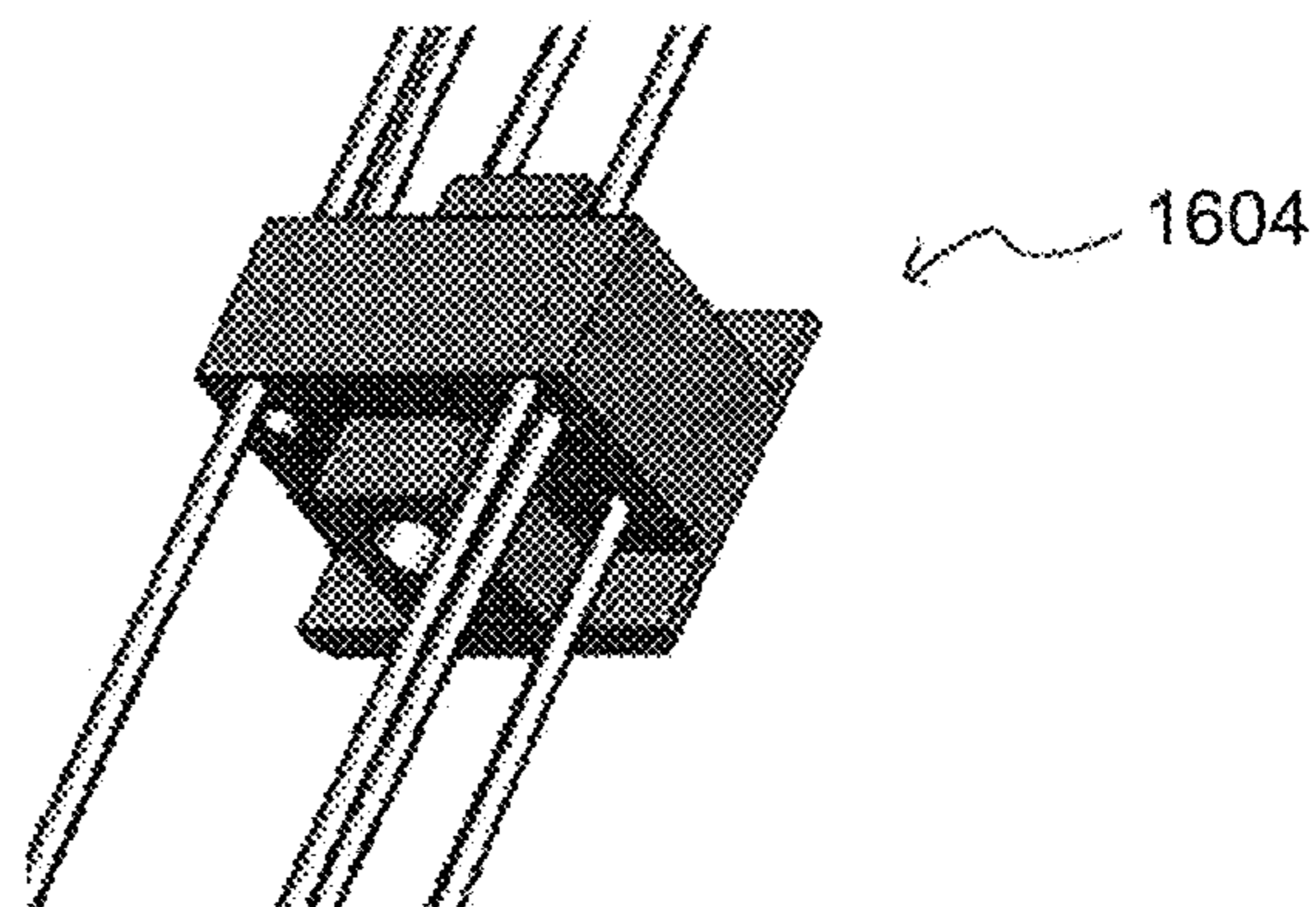
**FIG. 21A**



**FIG. 21B**



**FIG. 21C**





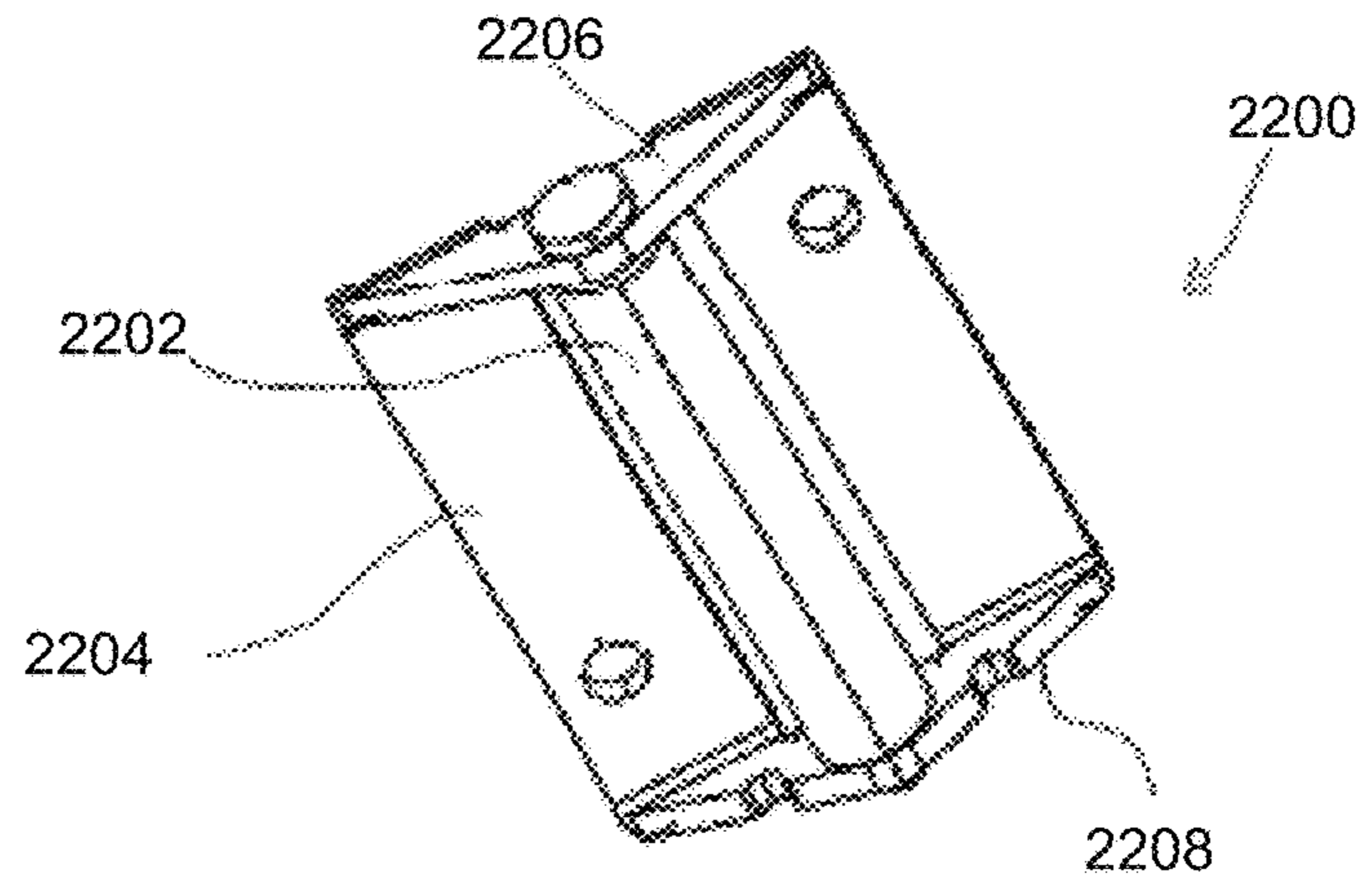


FIG. 22

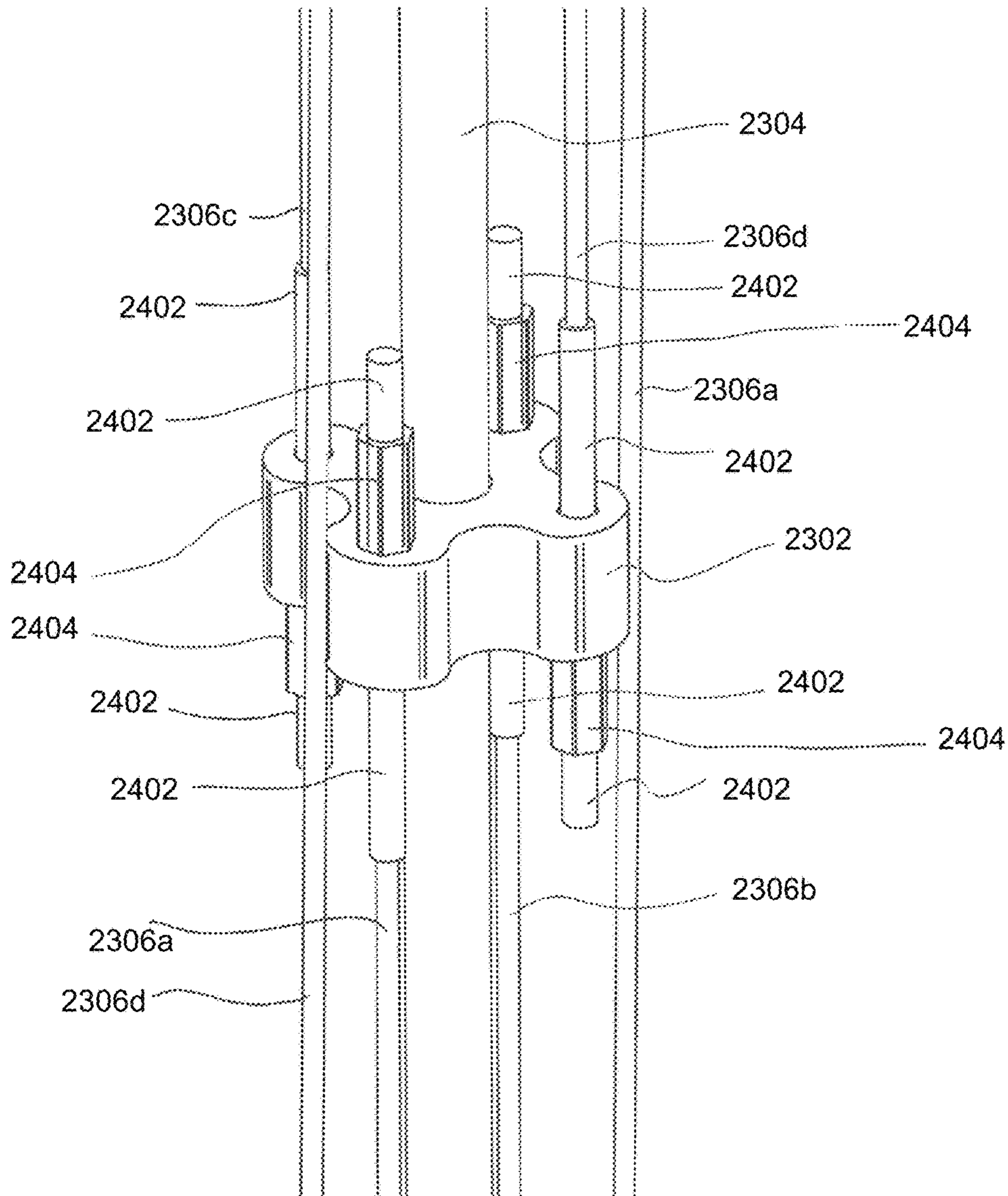


FIG. 24

FIG. 23

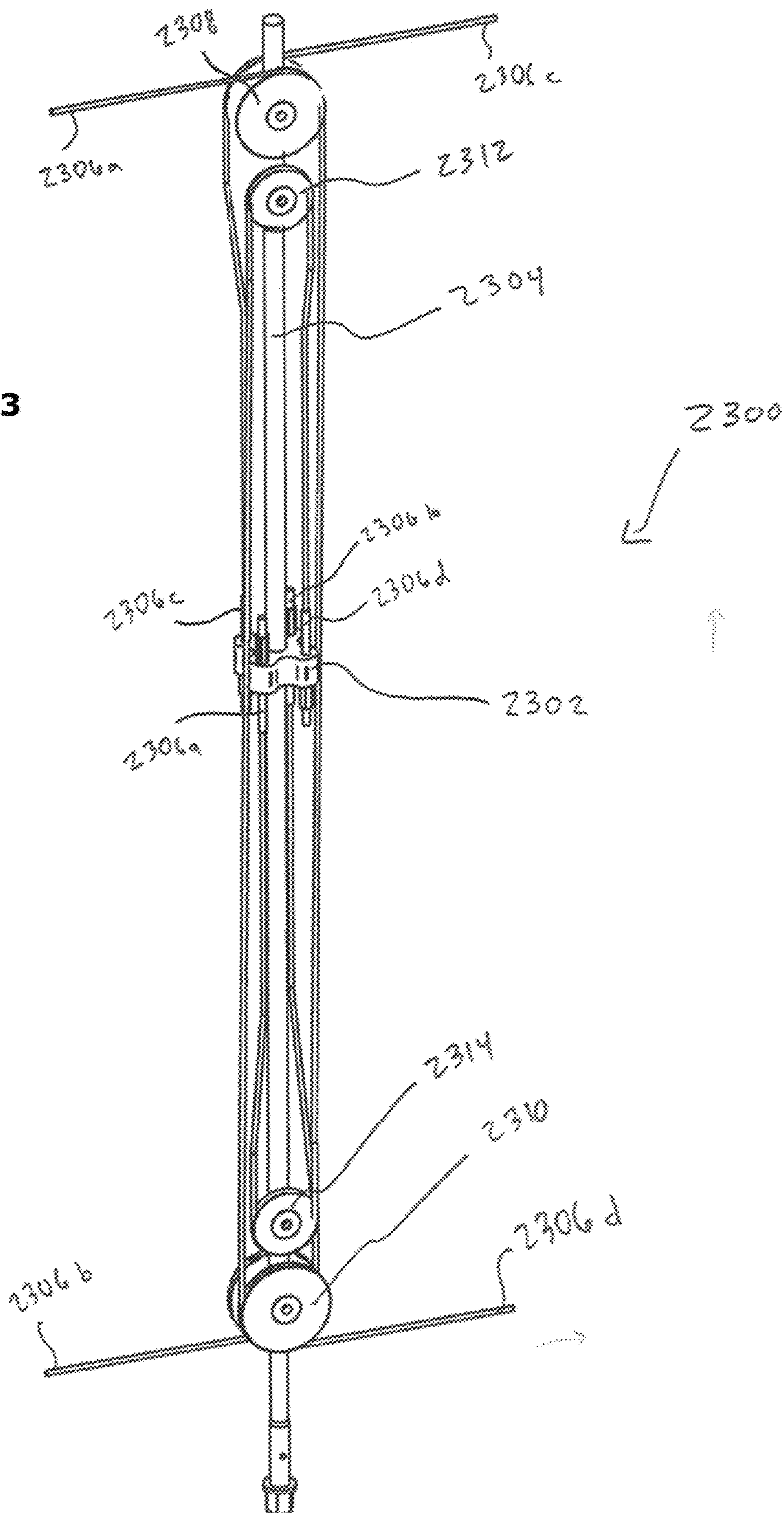
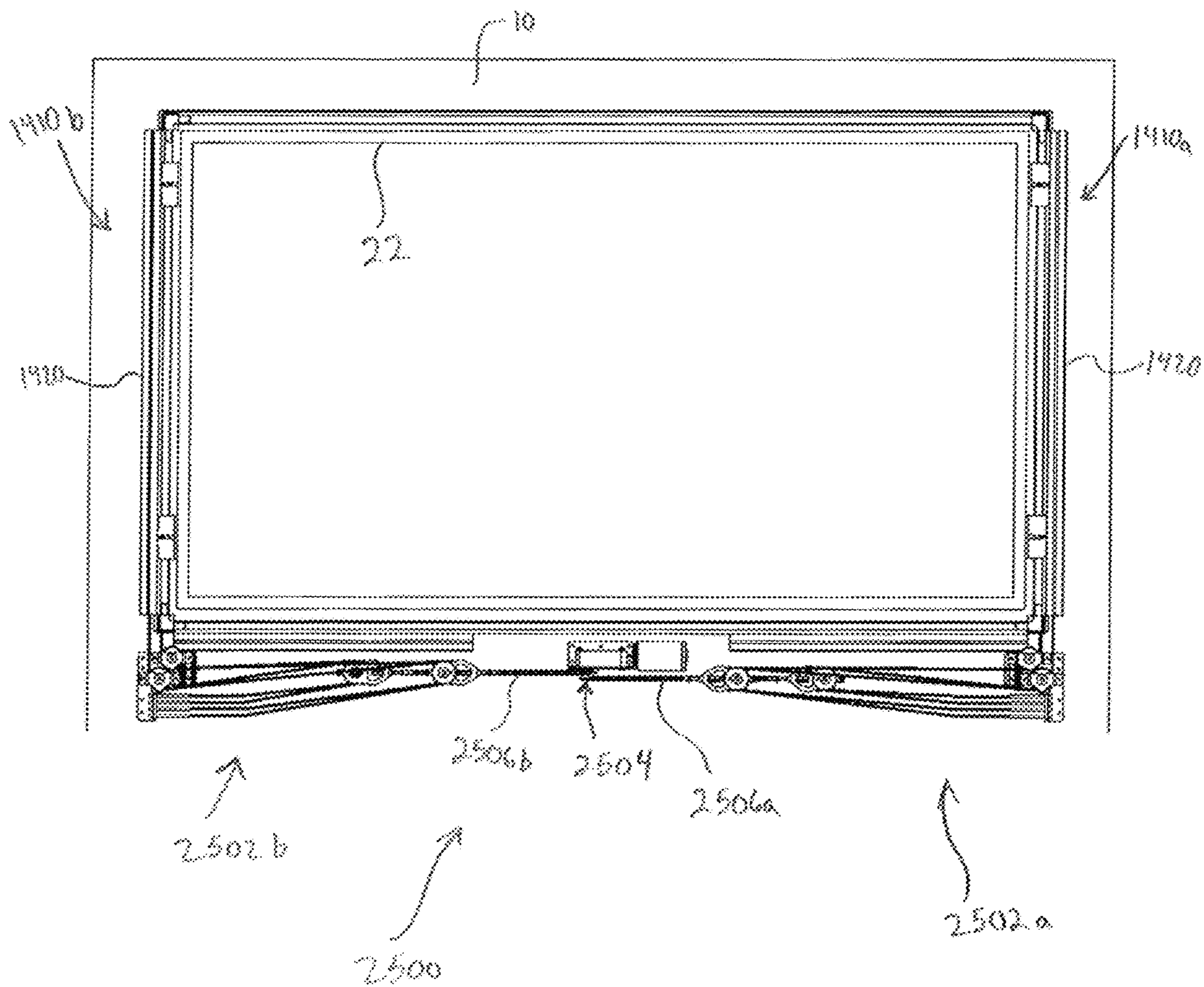




FIG. 25



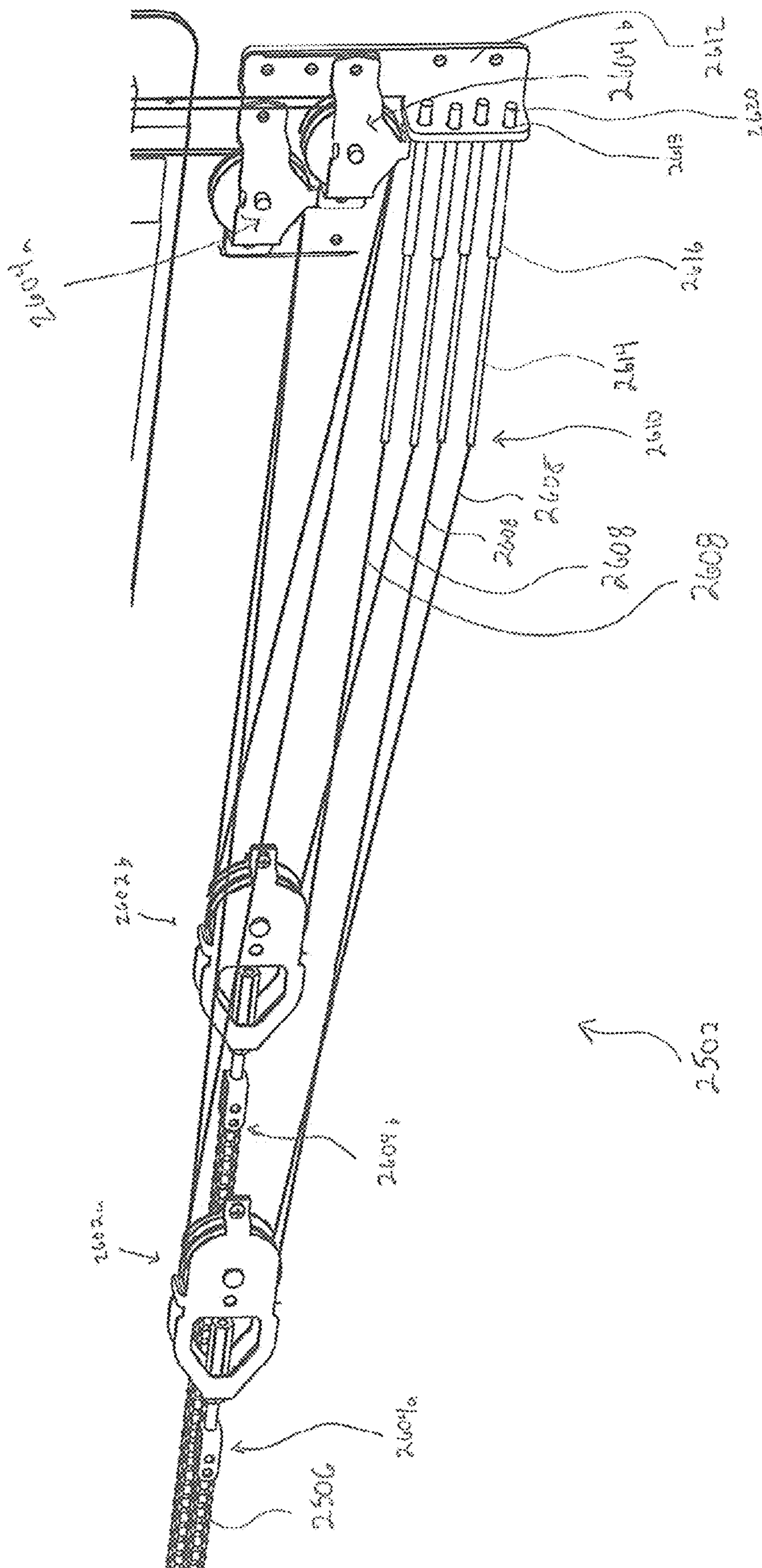
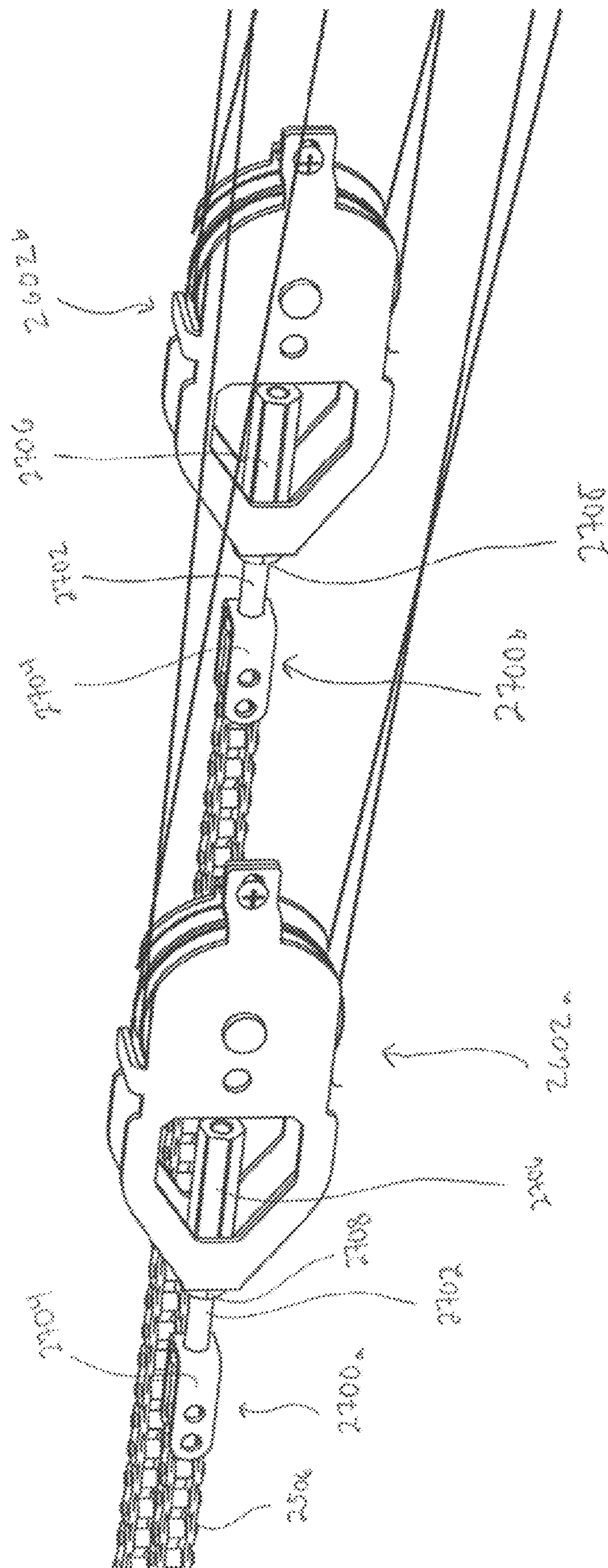


FIG. 26



FIG. 27







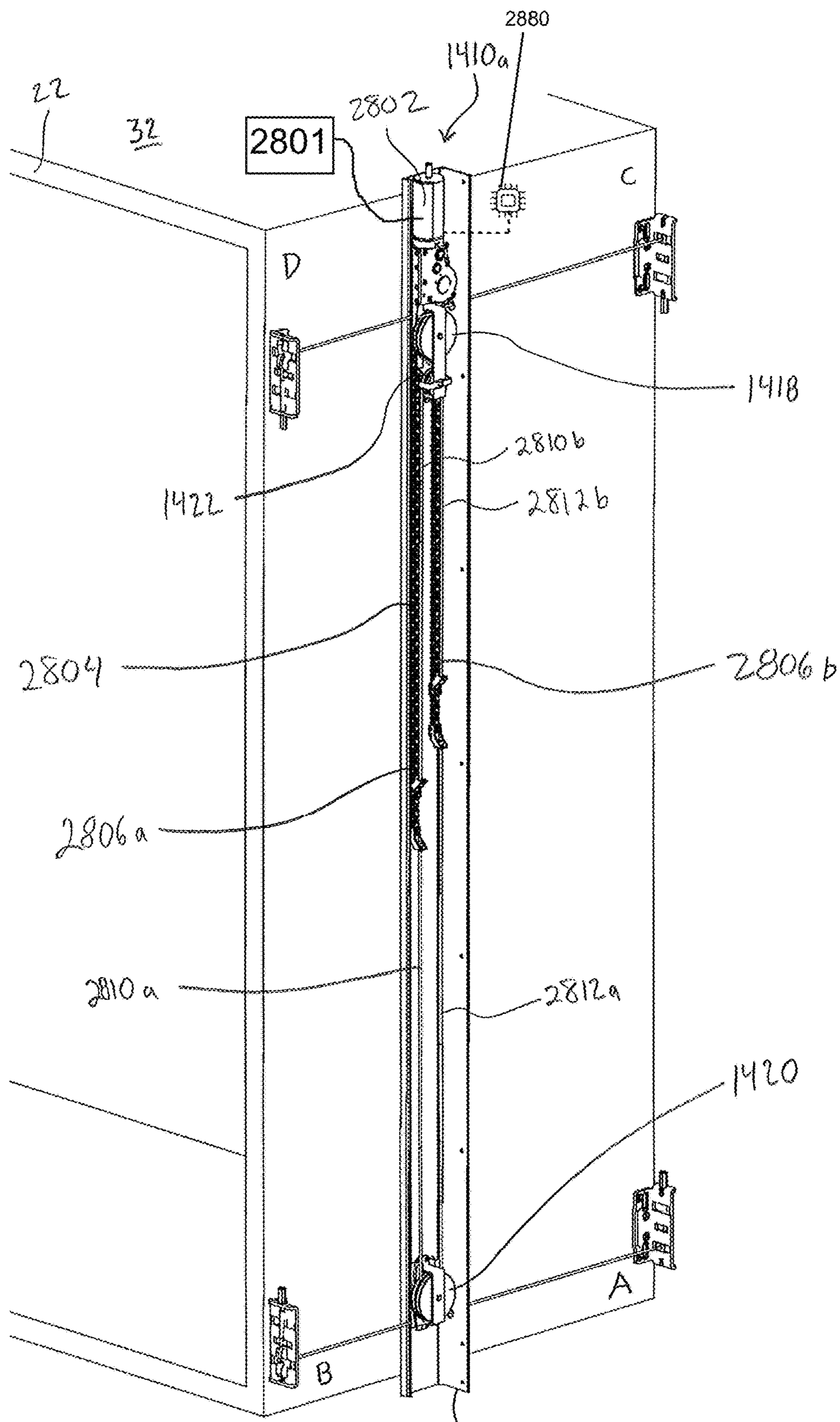


FIG. 28B

1420

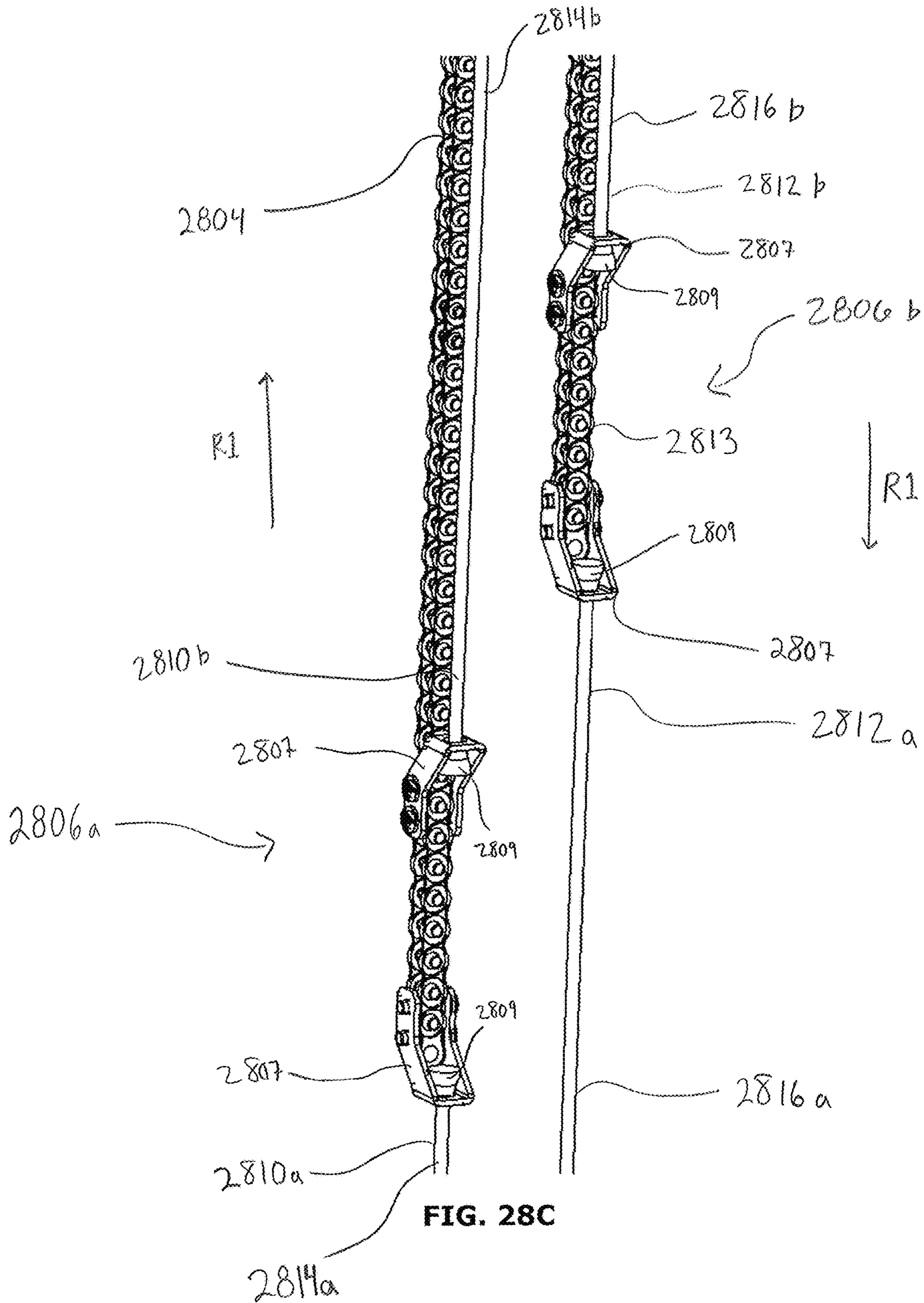


FIG. 28C



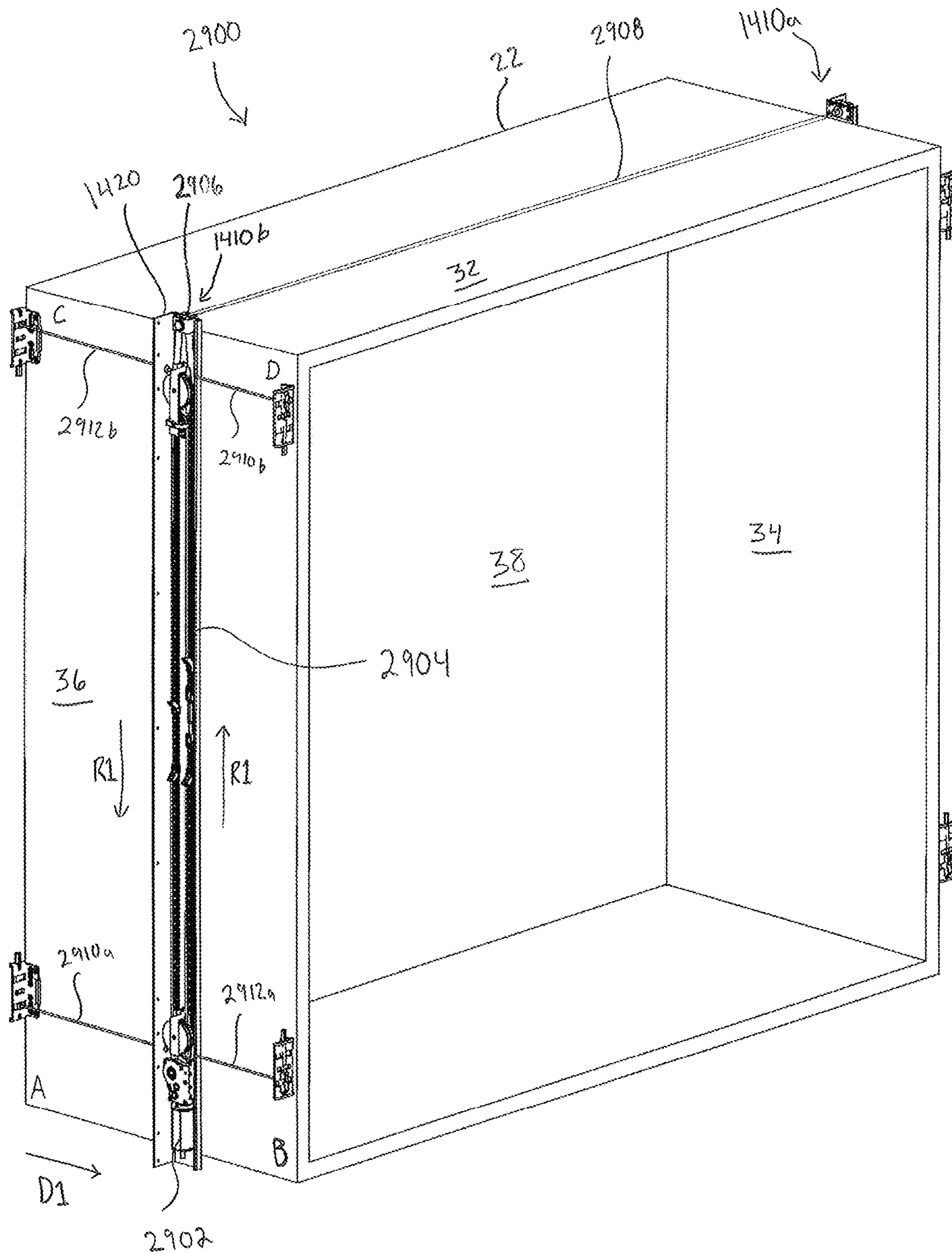


FIG. 29A

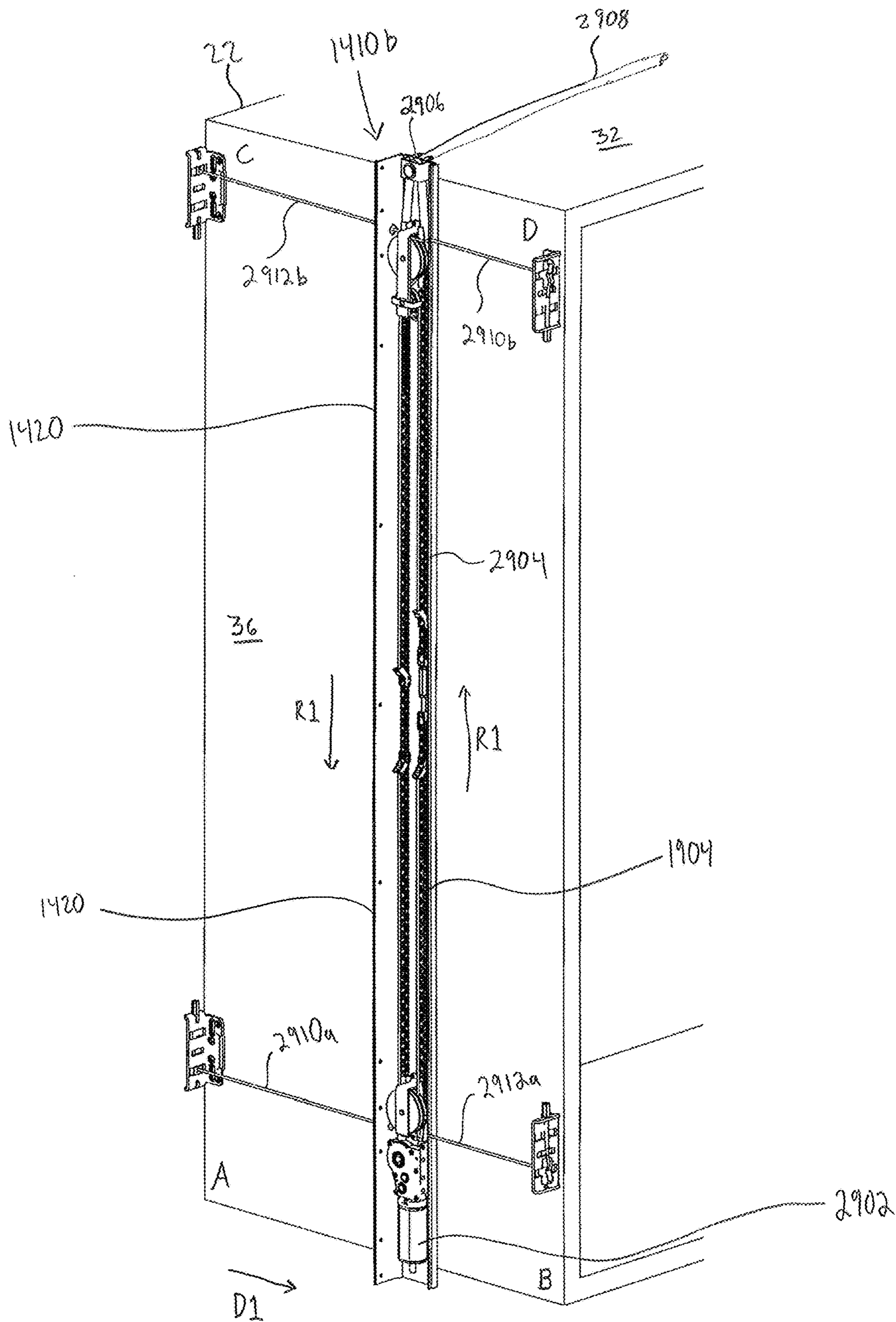


FIG. 29B



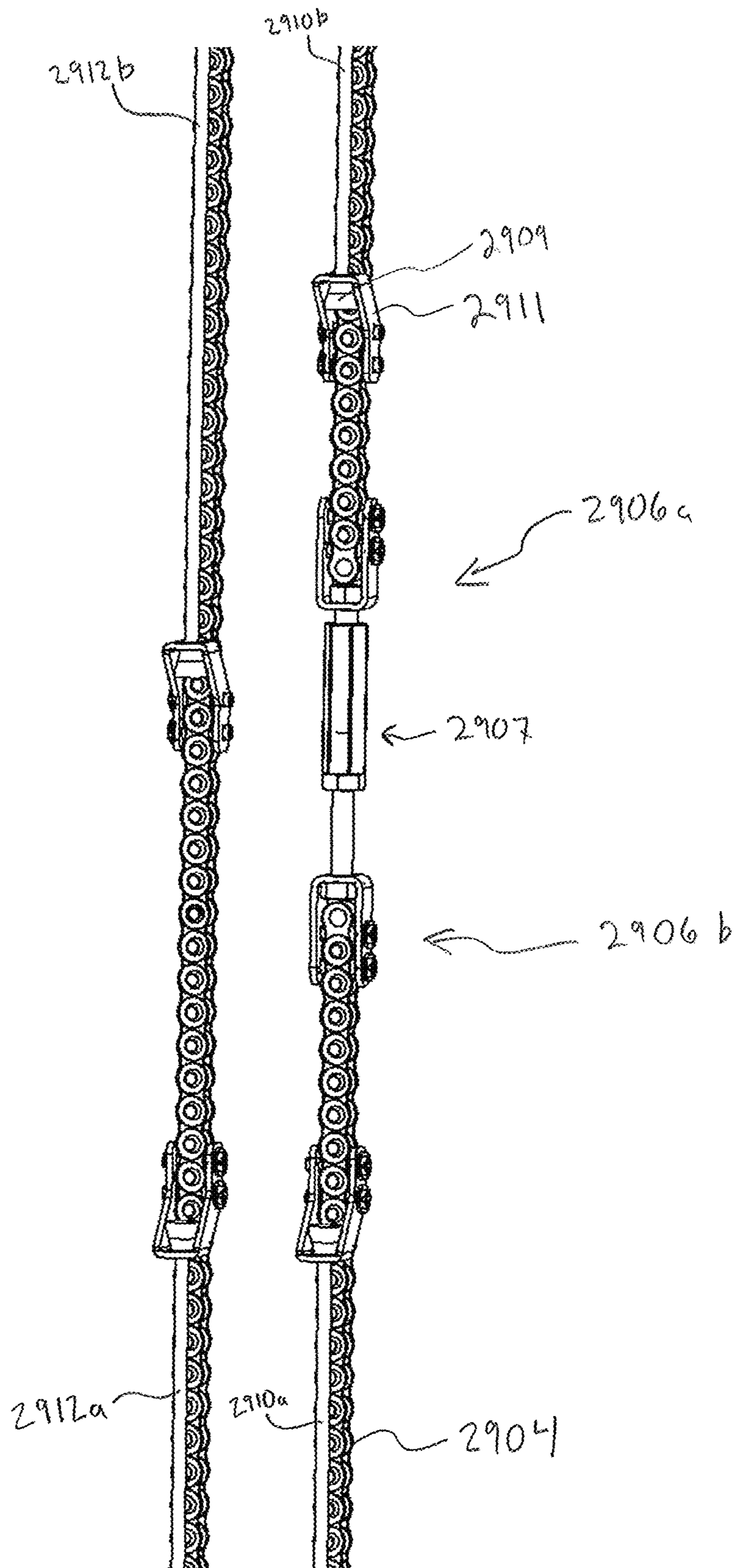
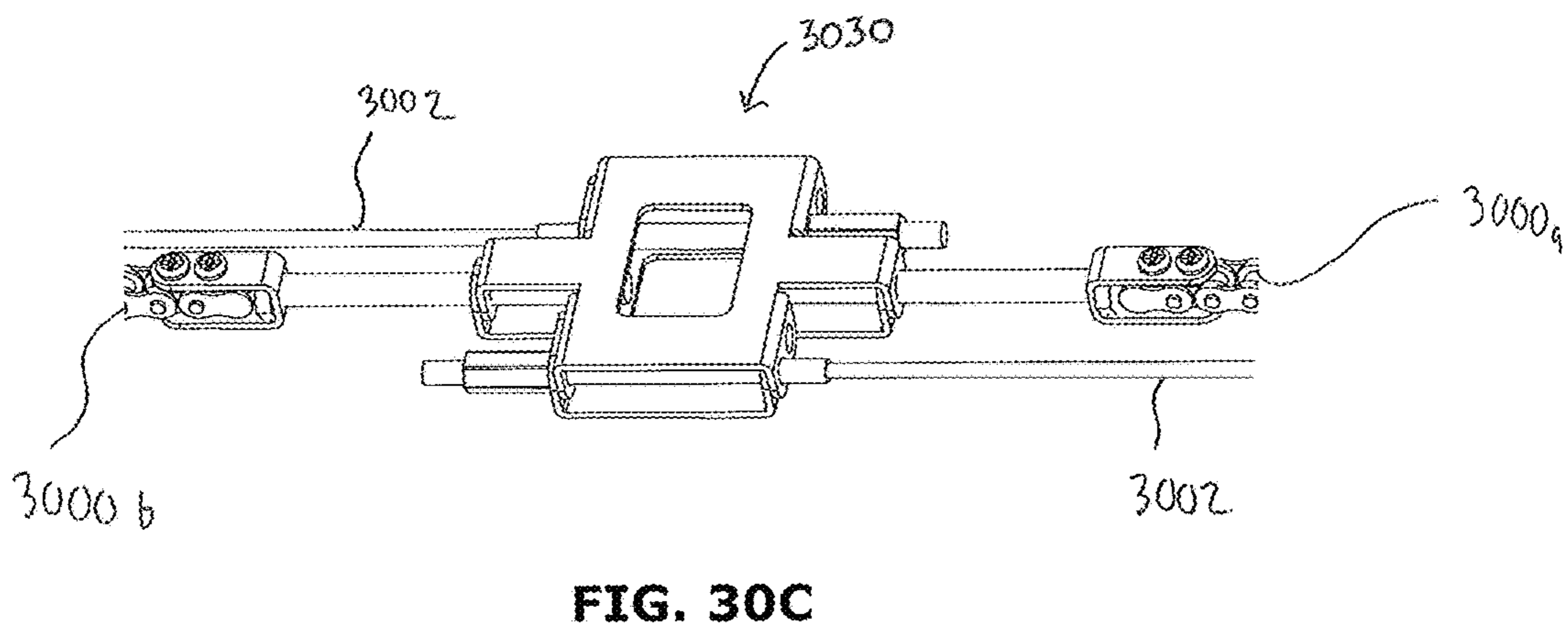
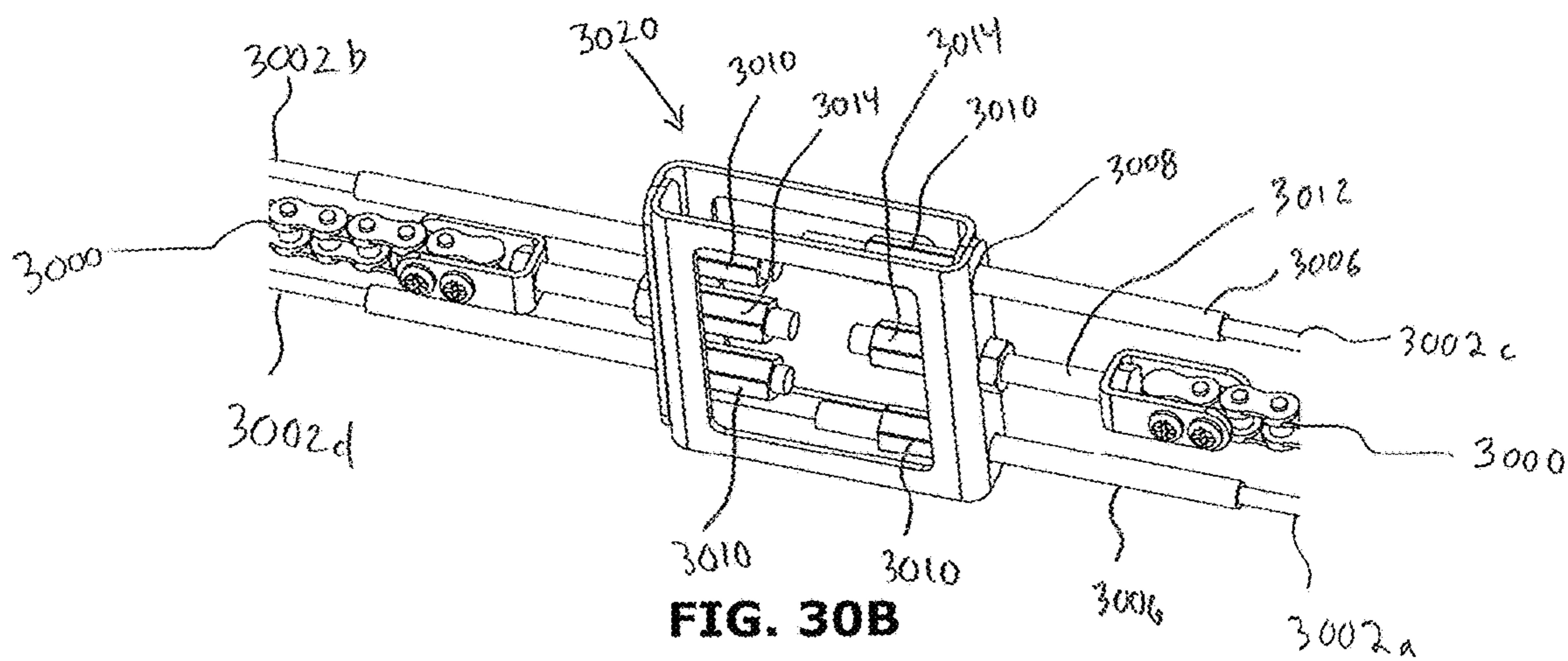
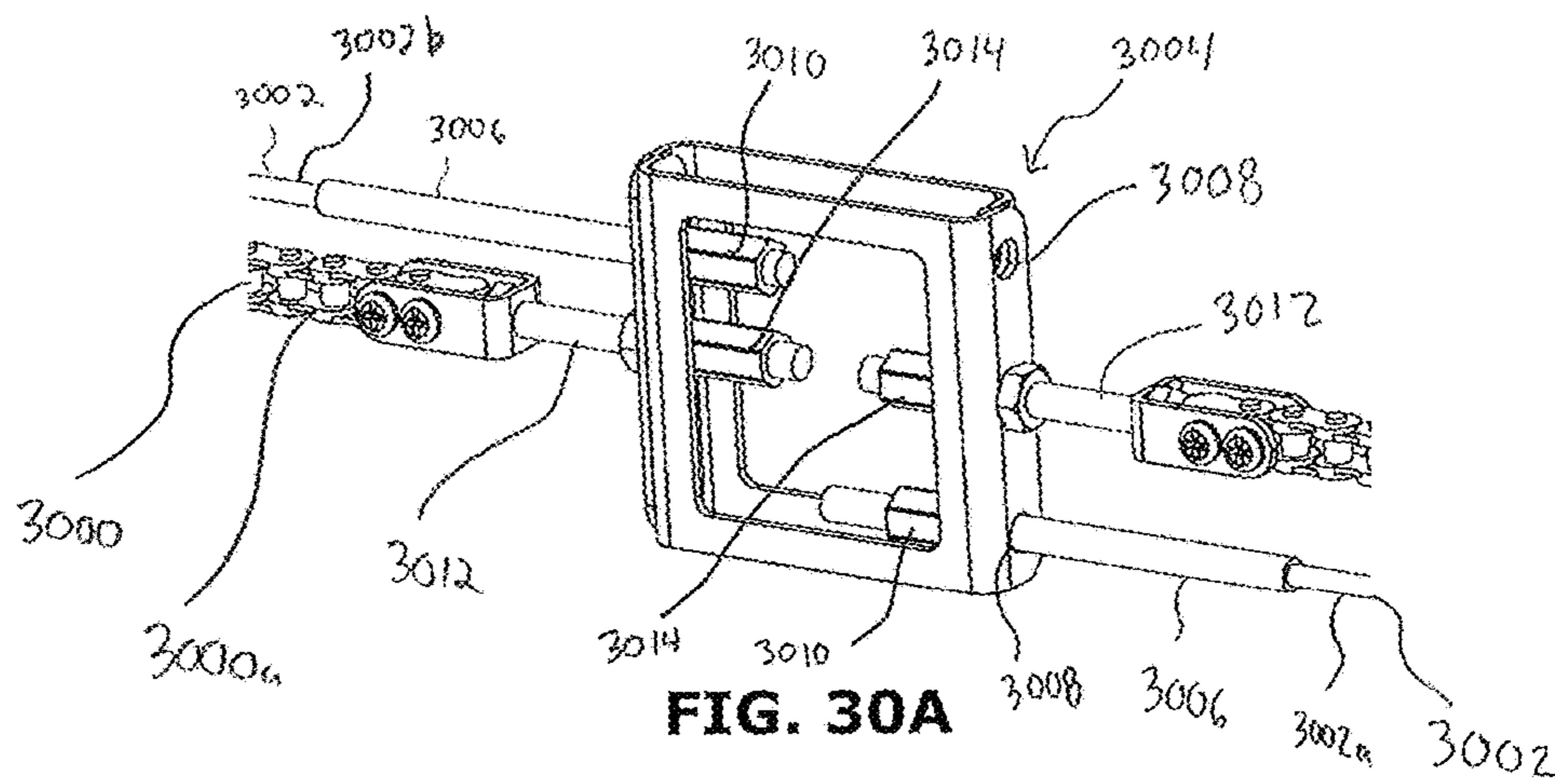


FIG. 29C





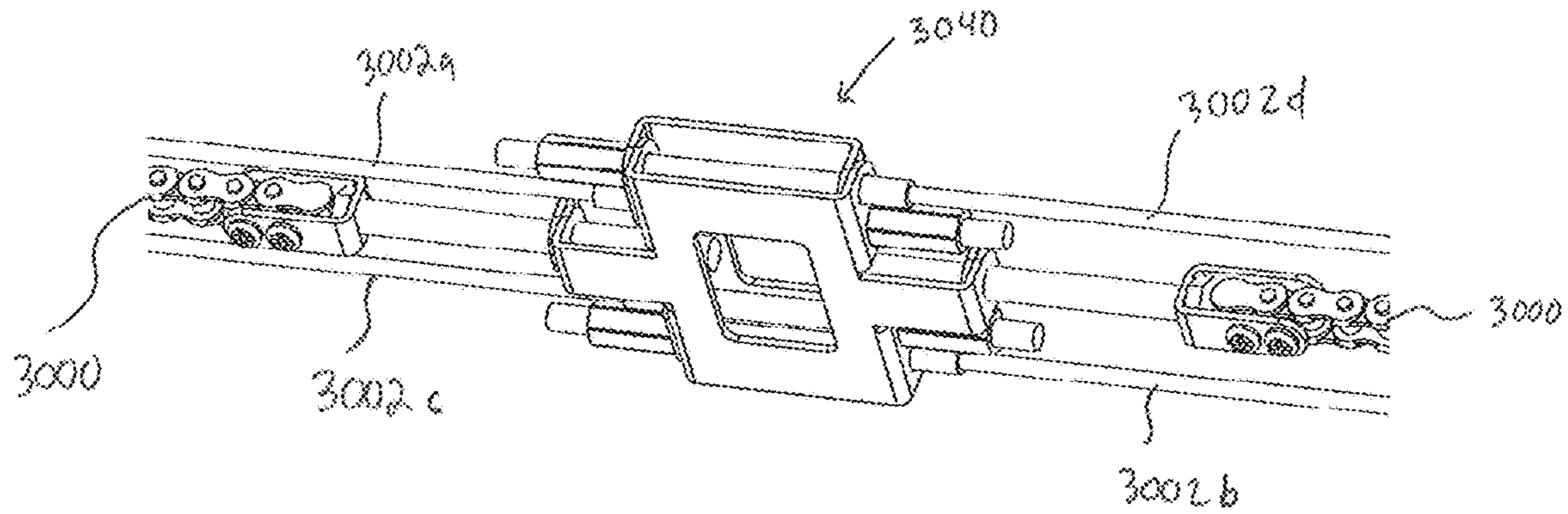


FIG. 30D

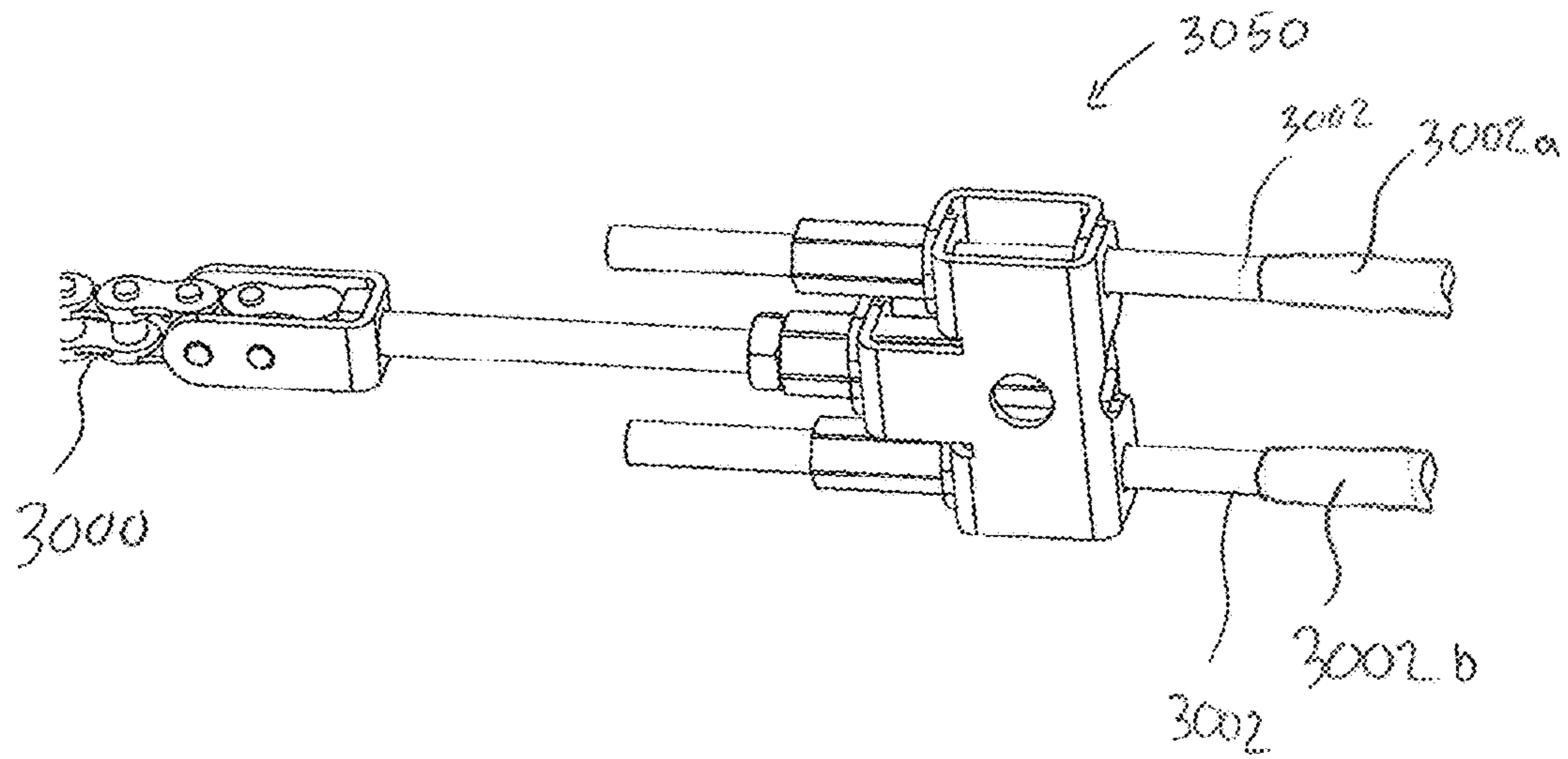


FIG. 30E

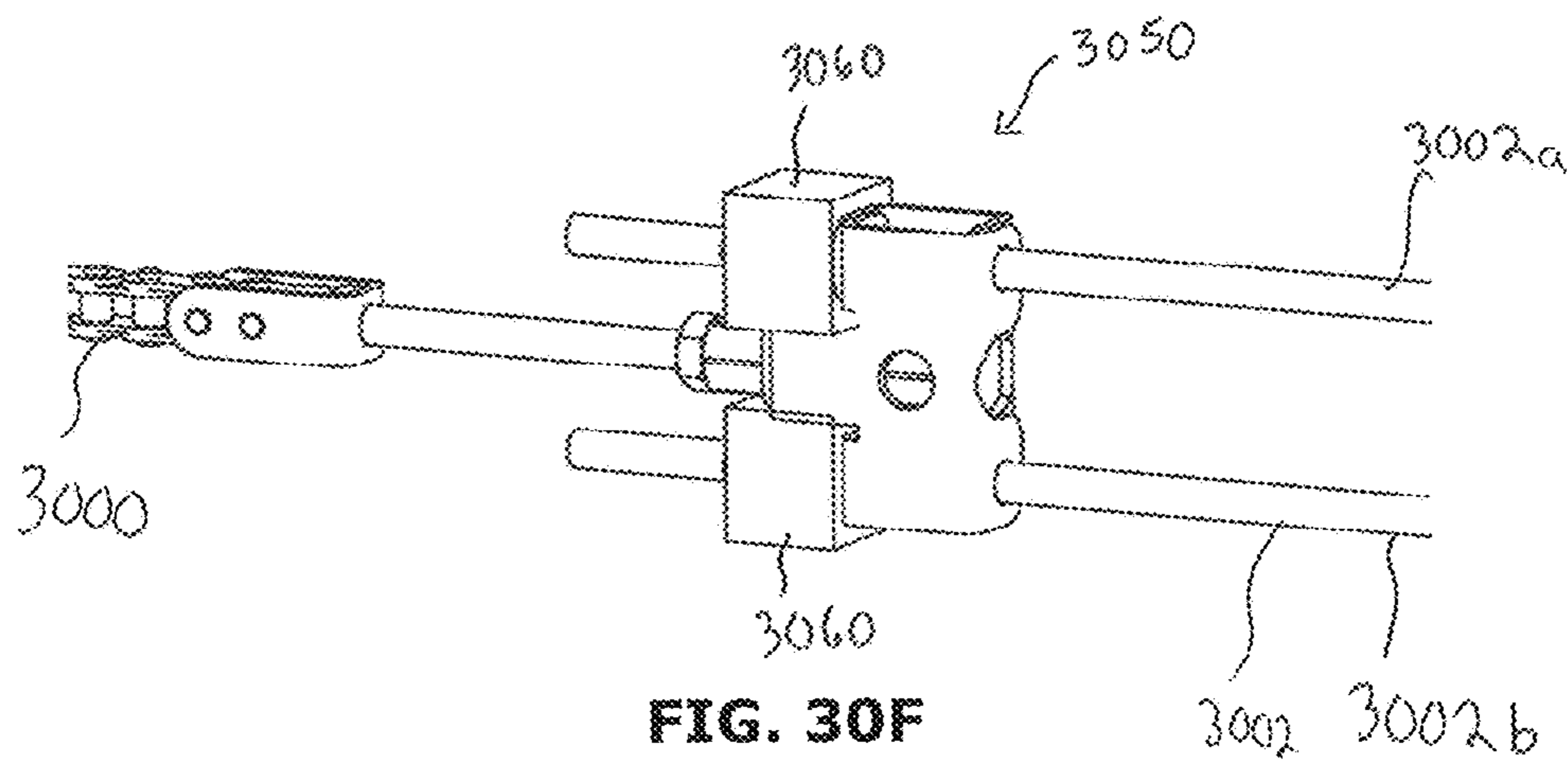


FIG. 30F

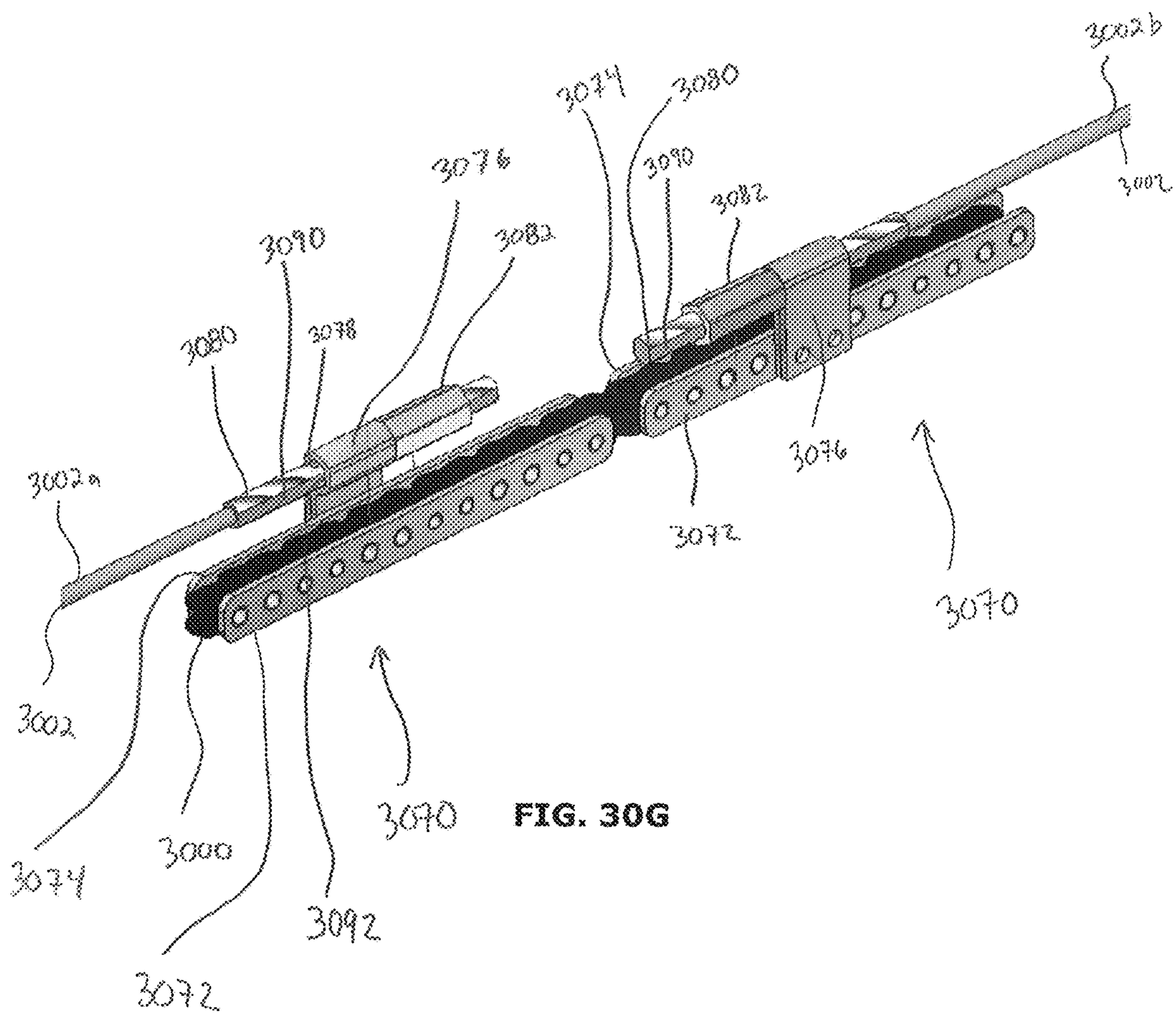


FIG. 30G



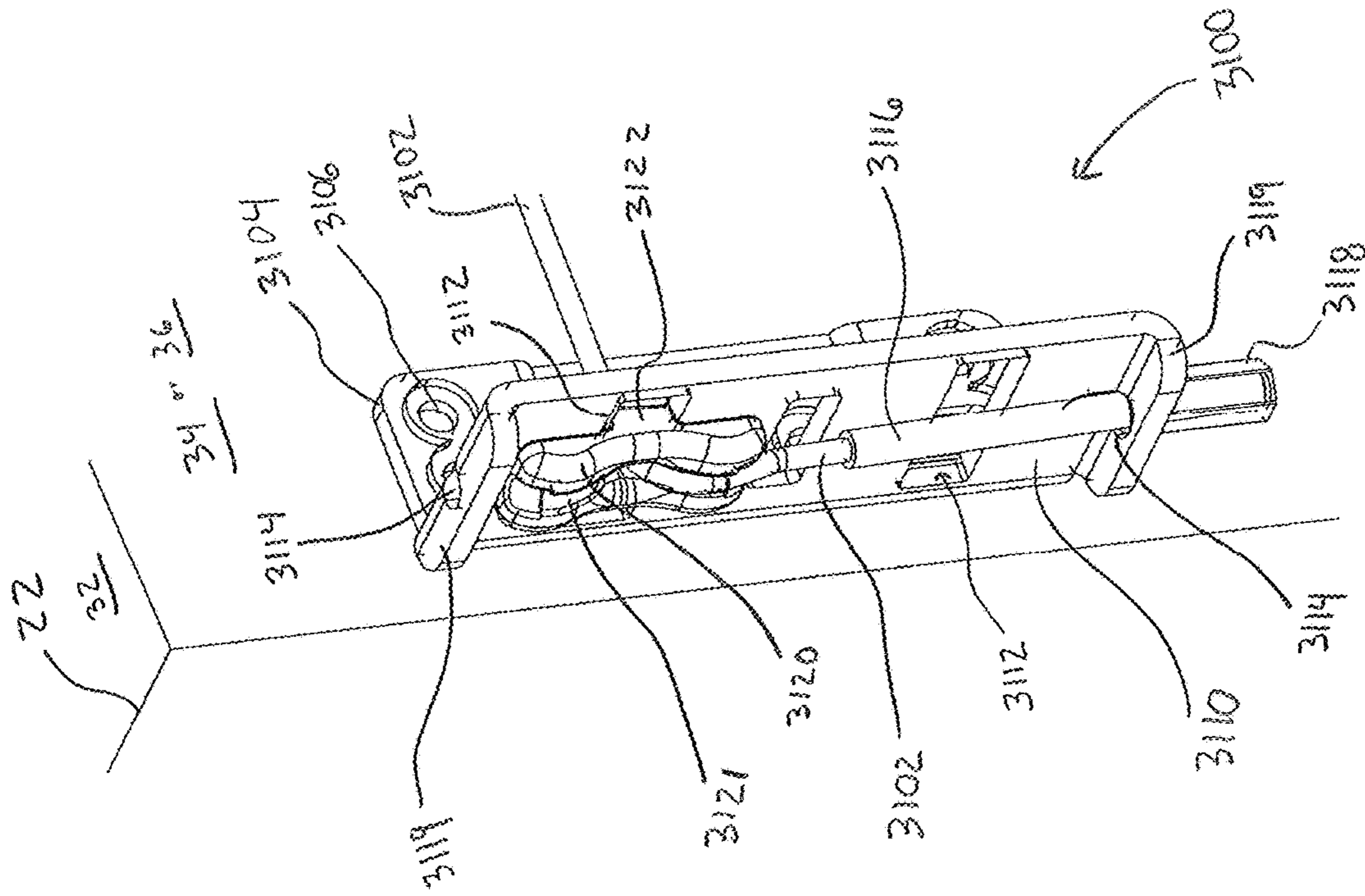


FIG. 31A

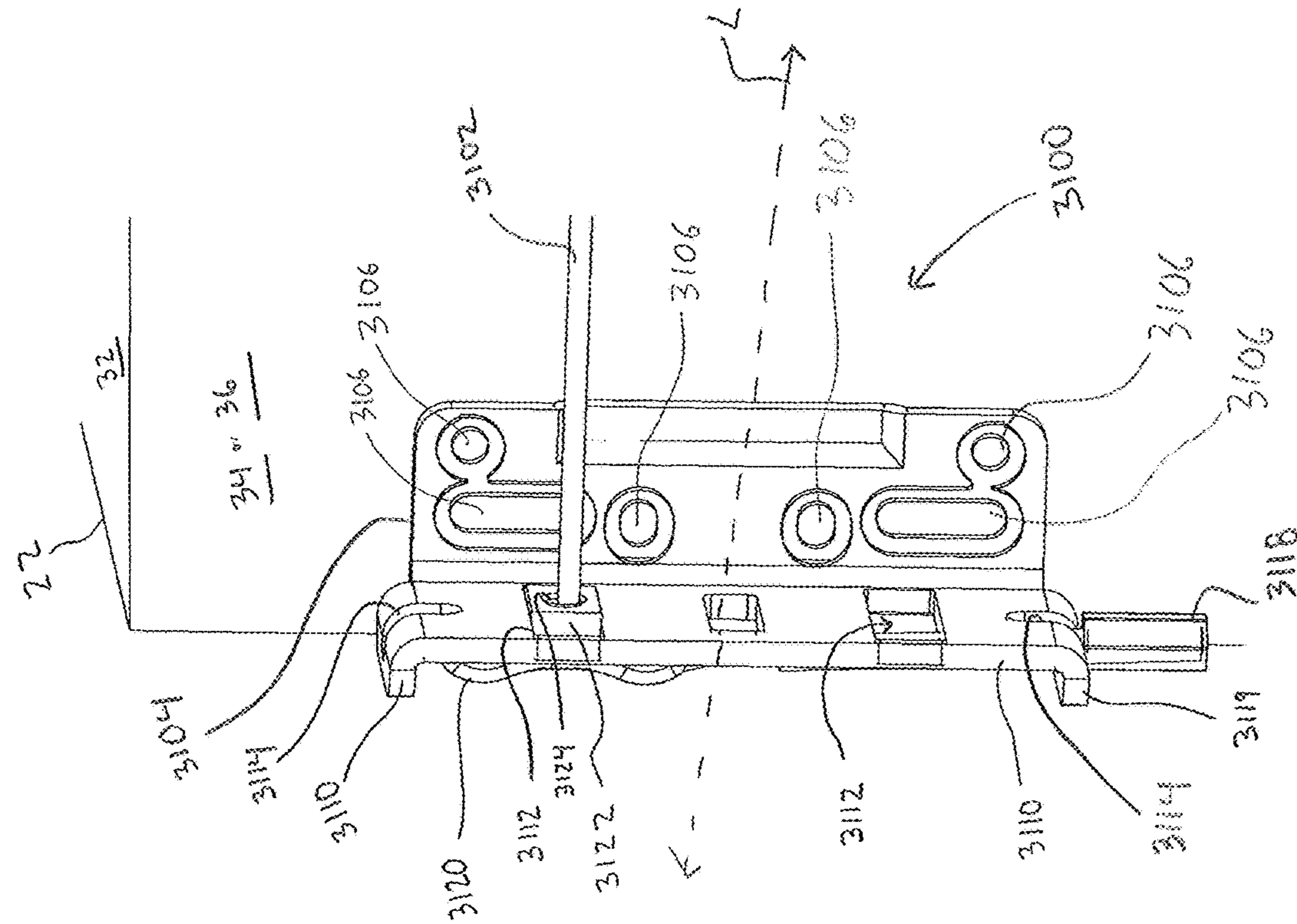


FIG. 31B

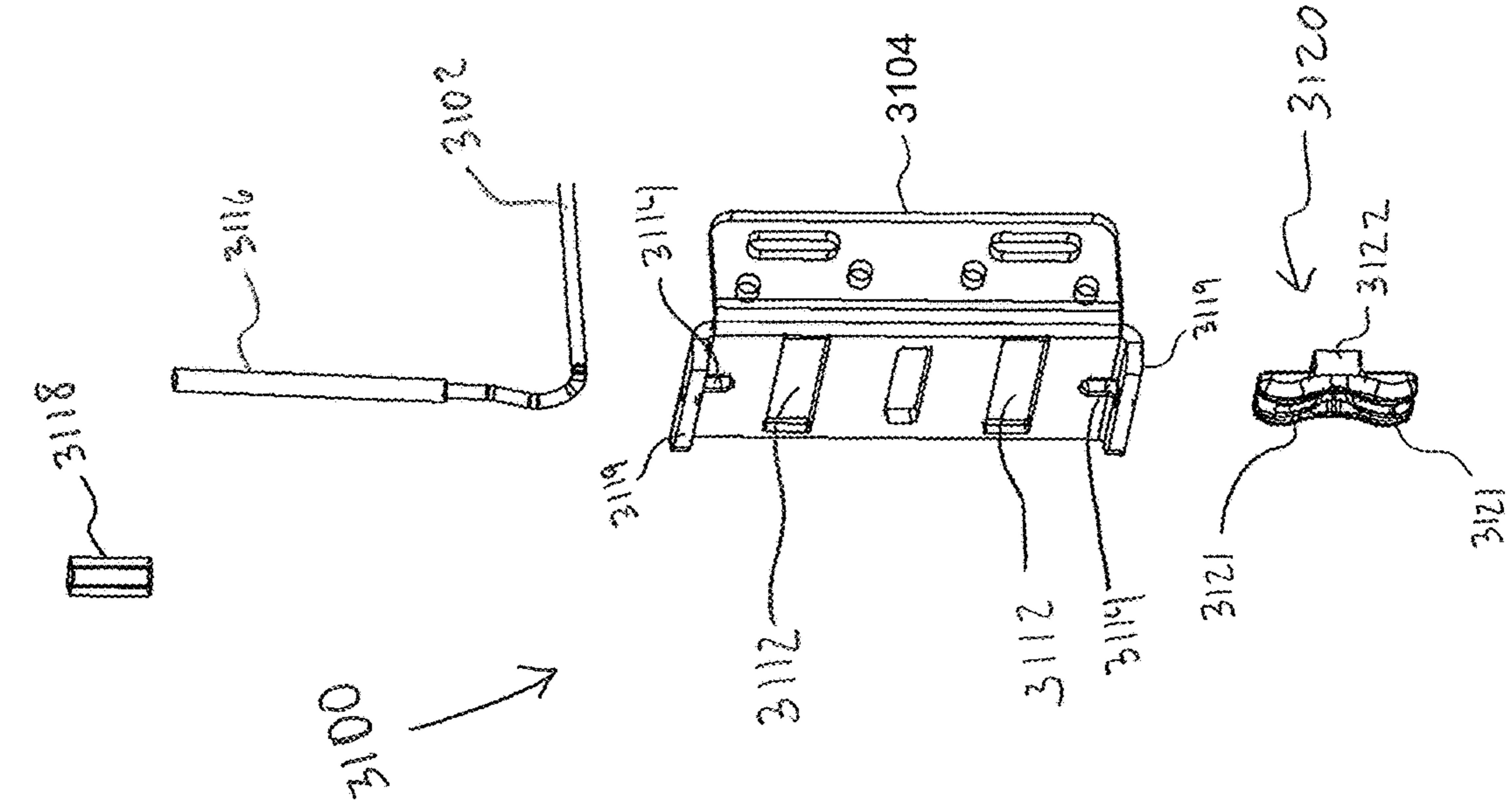


FIG. 310D

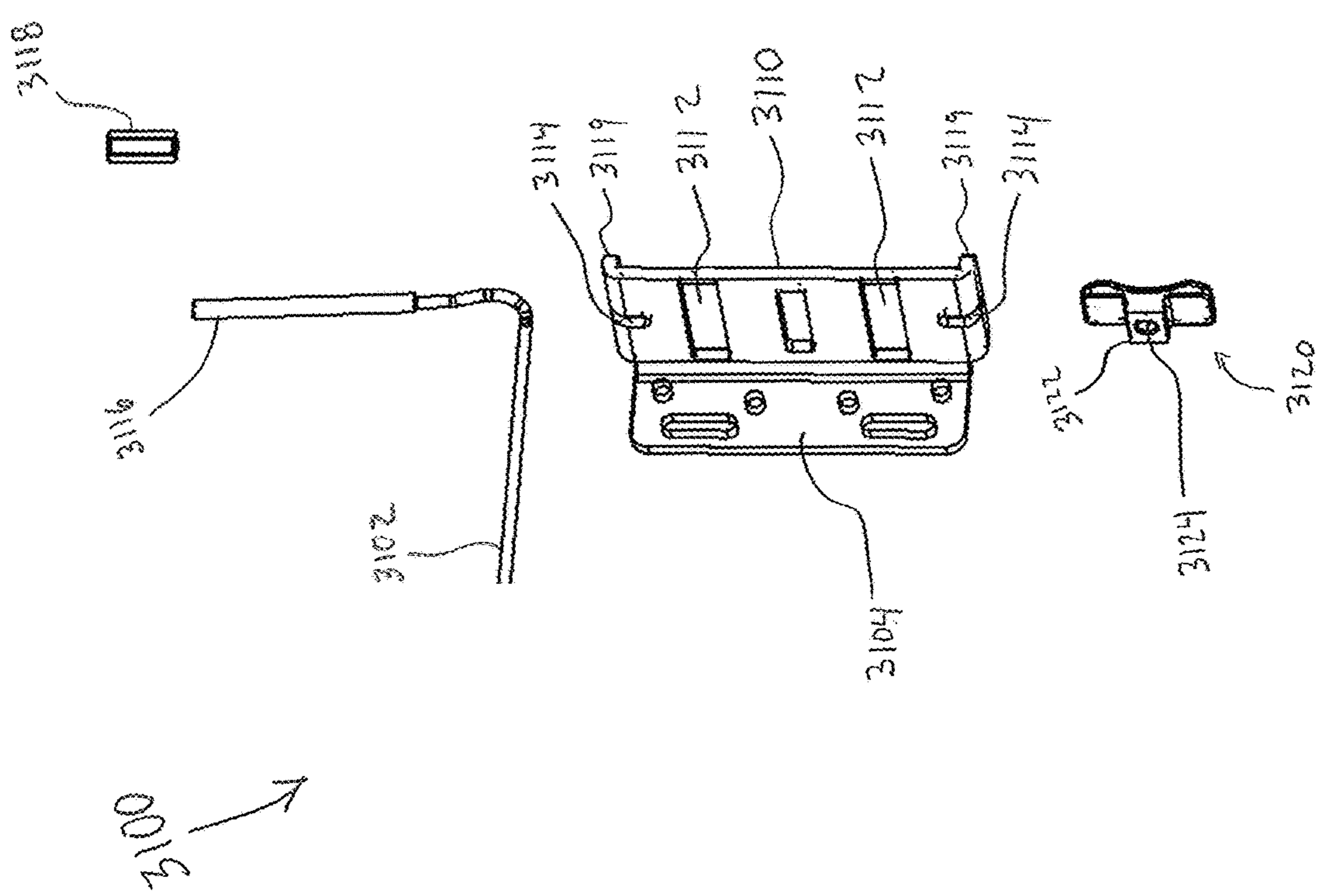


FIG. 310C



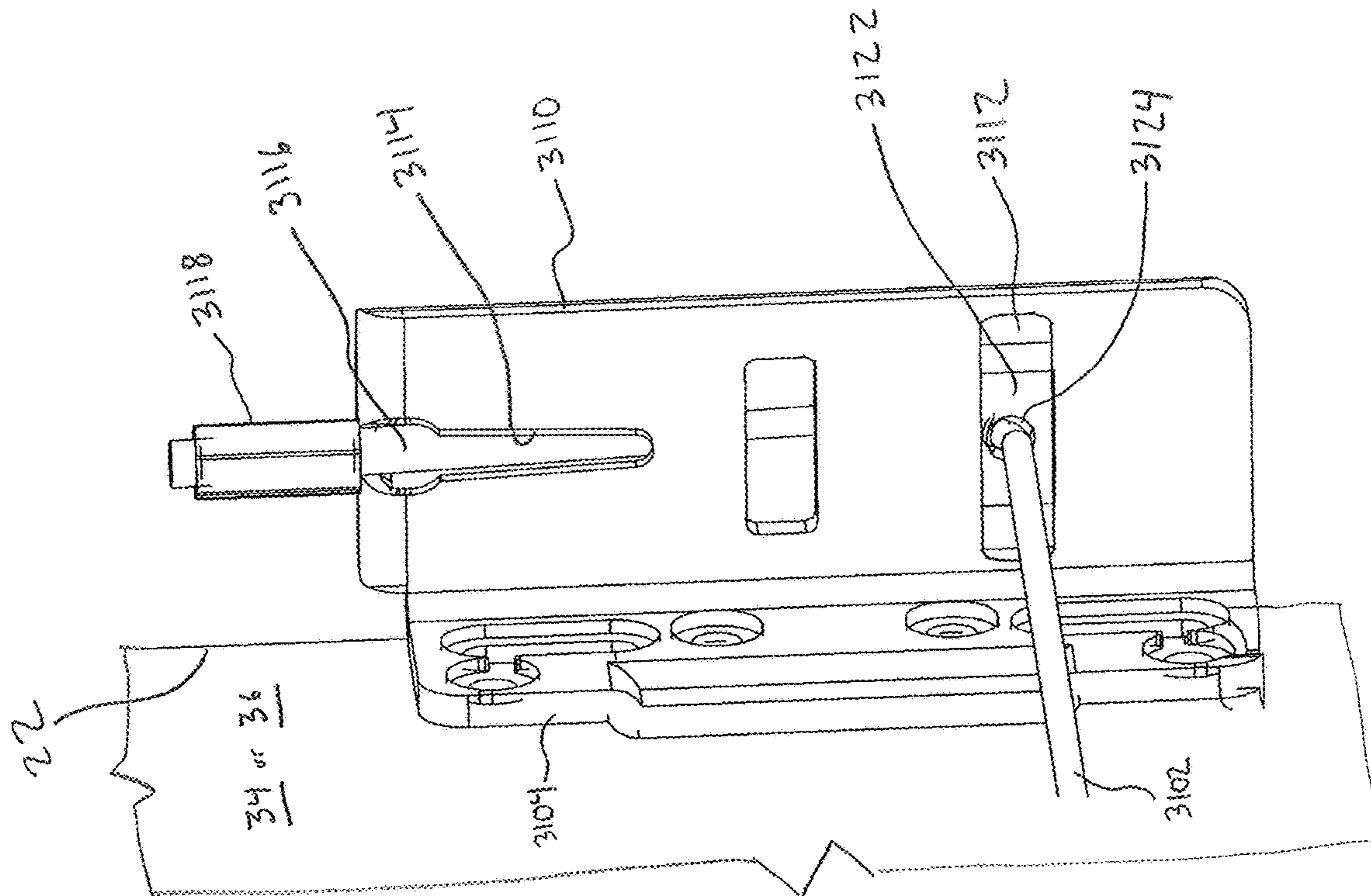


FIG. 32B

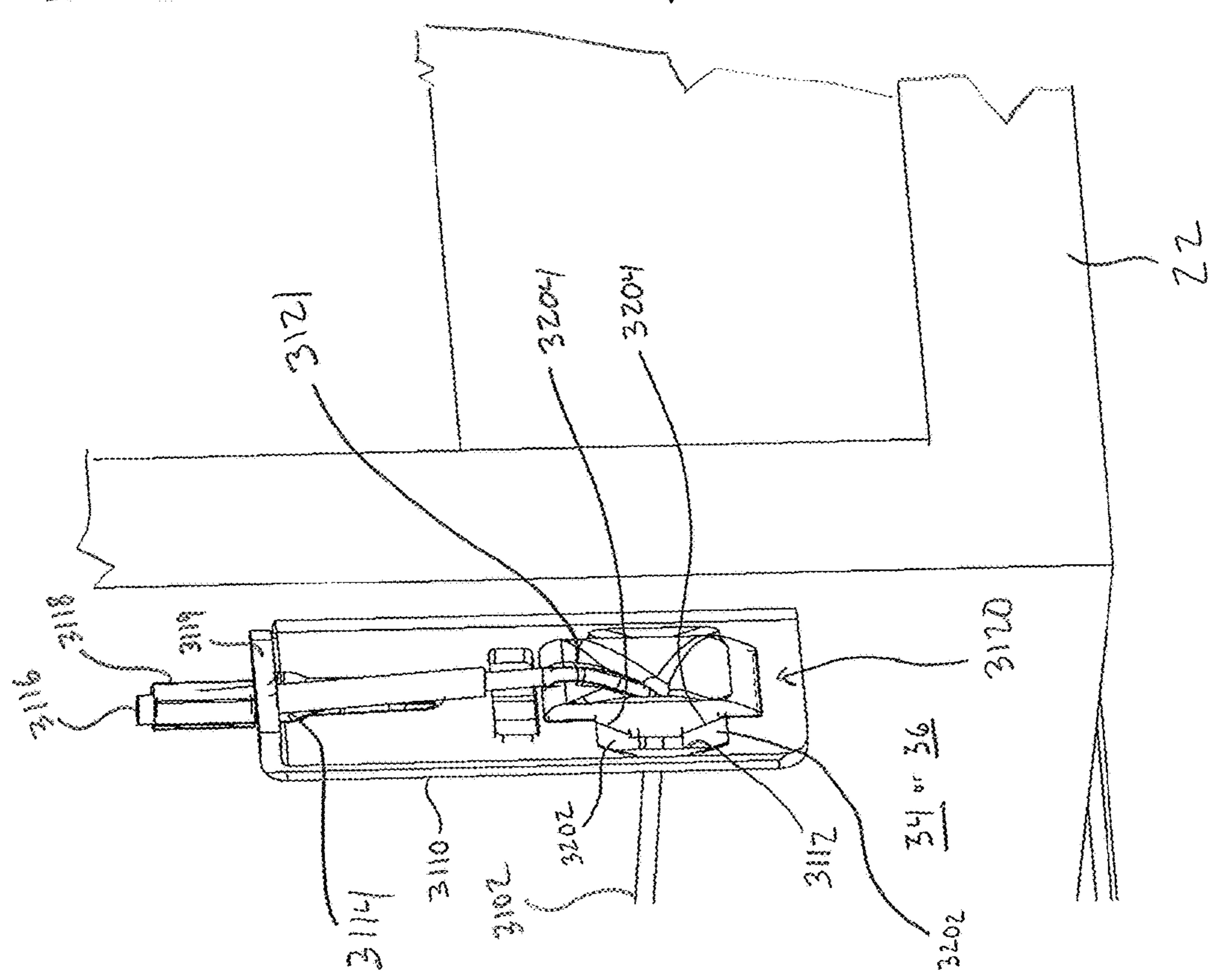


FIG. 32A





FIG. 35A

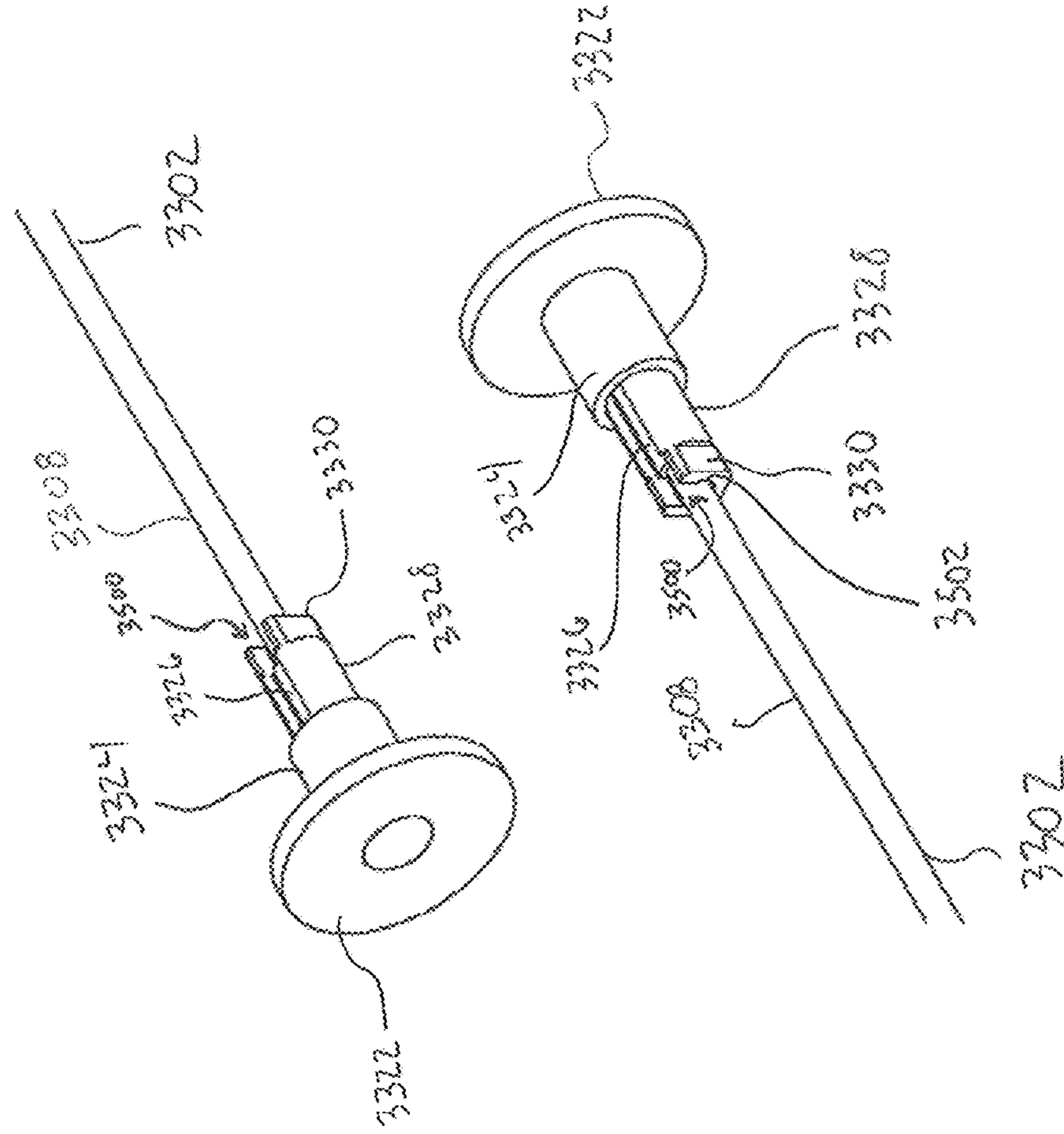


FIG. 35B

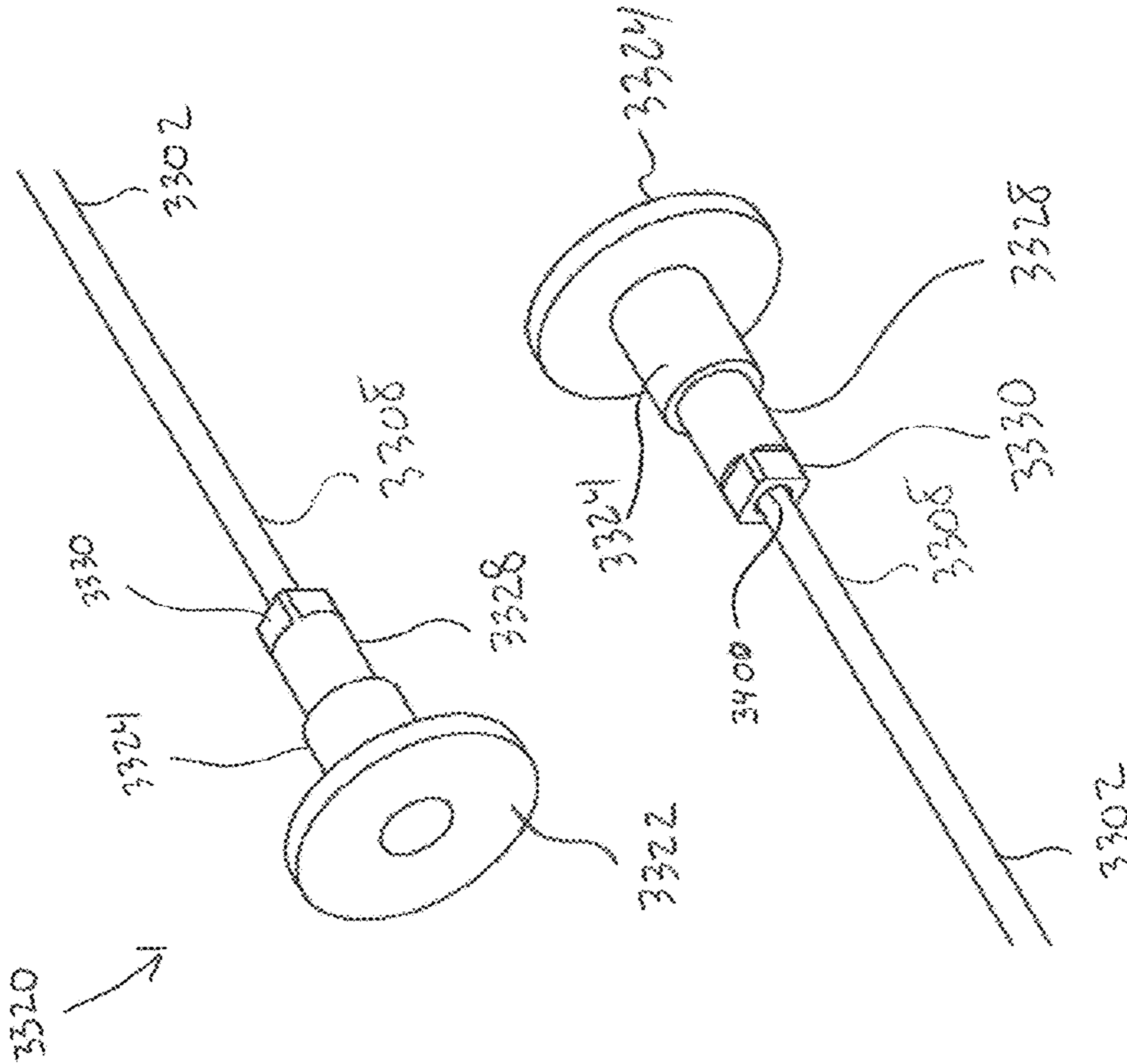


FIG. 34A

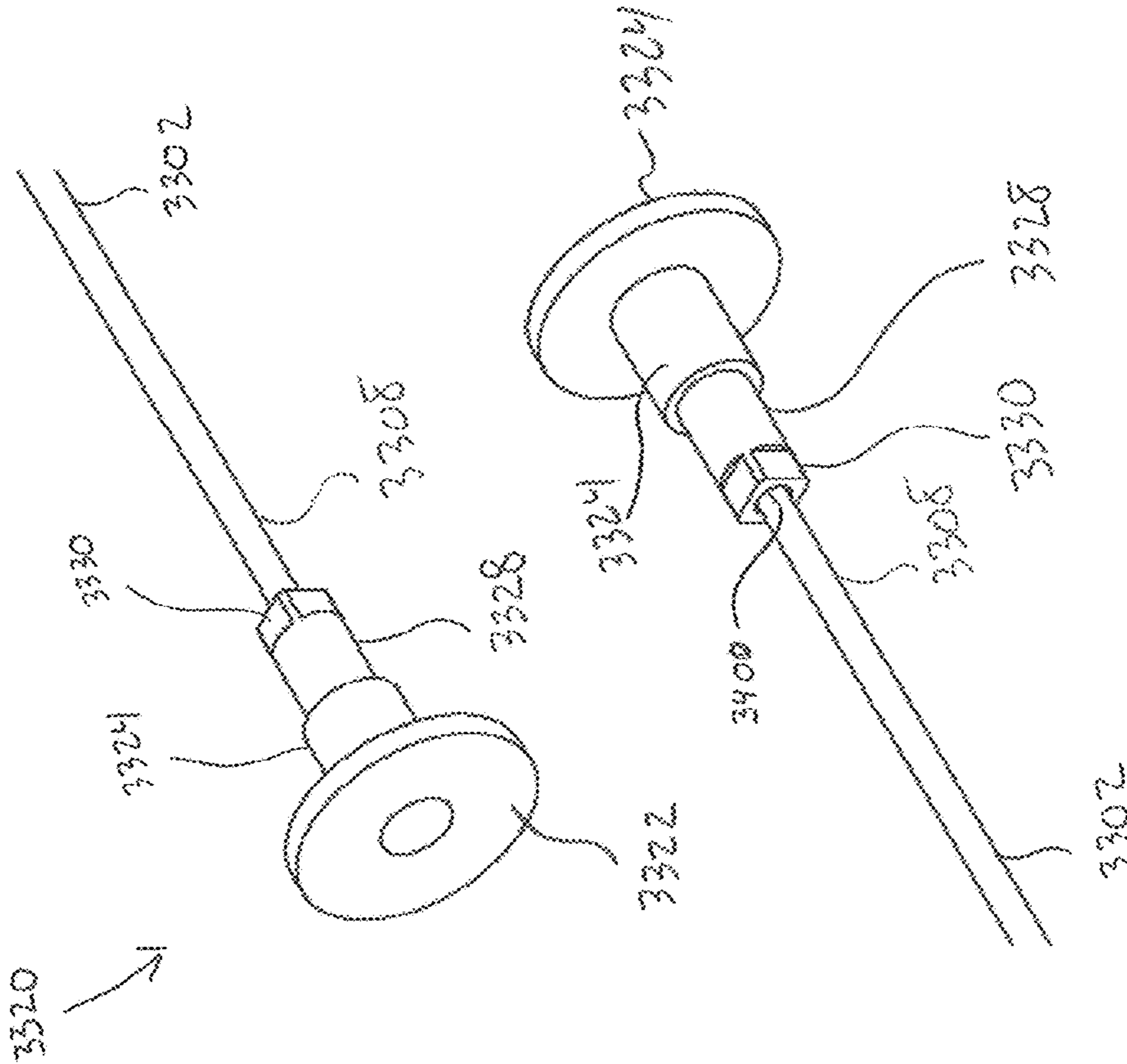


FIG. 34B

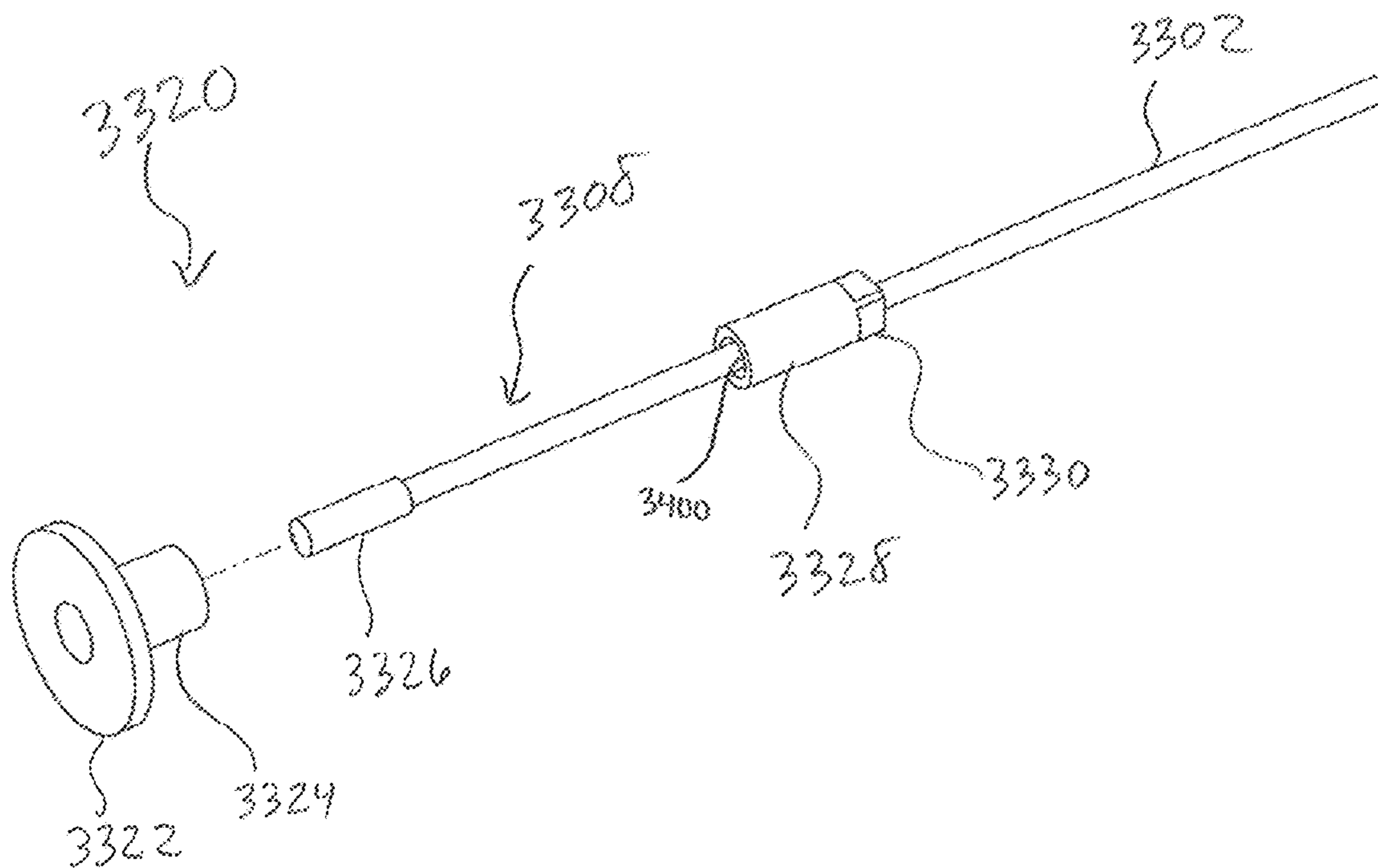


FIG. 34C

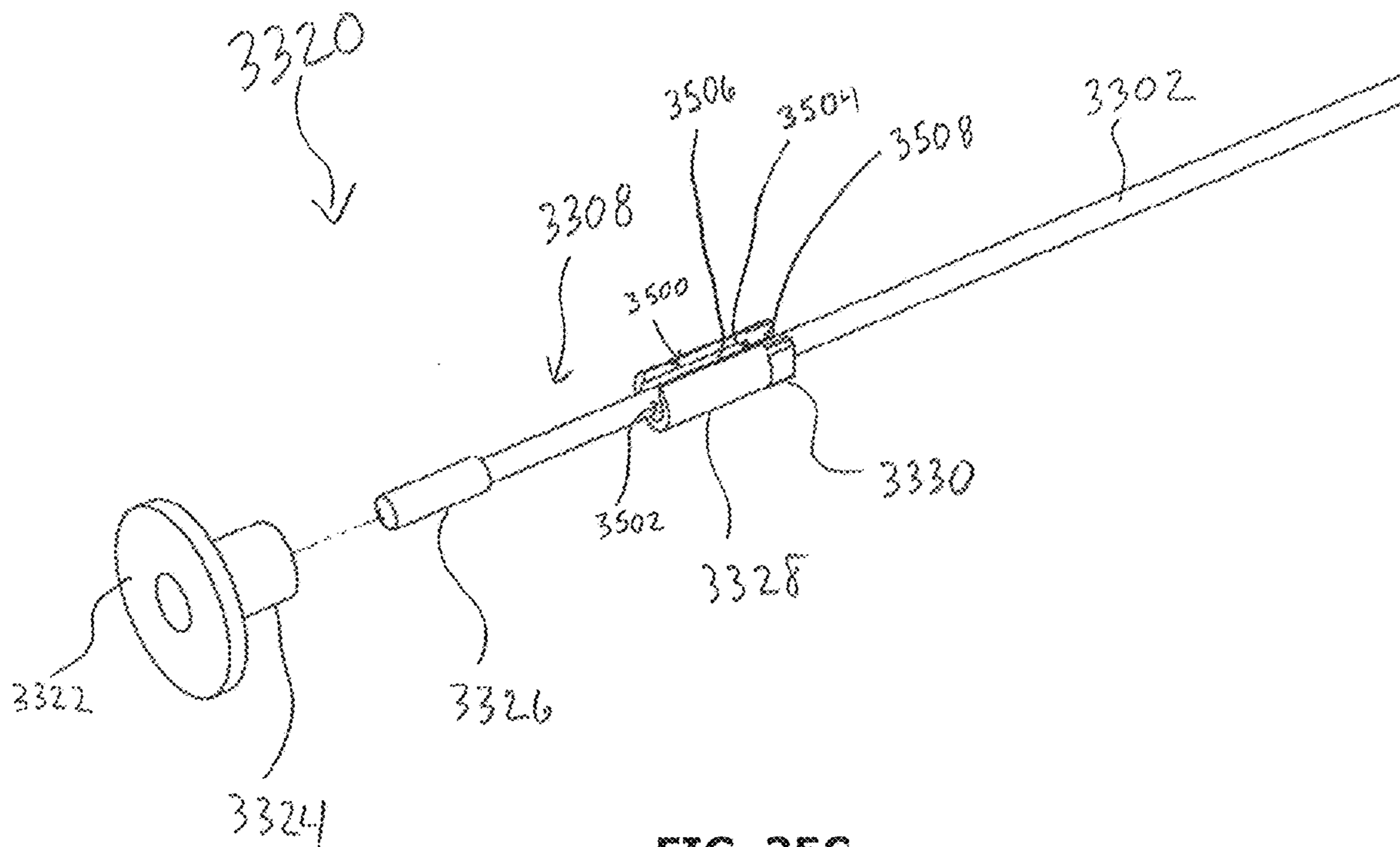


FIG. 35C



**SLIDABLE ROOM ASSEMBLIES****CROSS-REFERENCE TO RELATED APPLICATION**

This patent application claims priority to and the benefit of provisional patent application 62/732,330 filed on Sep. 17, 2018, and provisional patent application 62/858,712 filed on Jun. 7, 2019, both of which are incorporated by reference herein in their entirety, and this patent application is a continuation-in-part of U.S. patent application Ser. No. 16/136,528 filed on Sep. 20, 2018, which claims priority to provisional patent application 62/562,084 filed on Sep. 22, 2017, which is incorporated by reference herein in its entirety.

**TECHNICAL FIELD**

The disclosures herein relate in general to slidable room assemblies. More particularly, aspects herein relate to slidable room assemblies installed within vehicle jambs.

**BACKGROUND**

The present subject matter relates to a slidable room assembly, particularly to a slidable room assembly for a vehicle having a slide-out room or compartment that is retracted when the vehicle is in motion and may be extended to afford more room when the vehicle is parked. More particularly, this subject matter relates to a slidable room assembly that includes an improved mechanism for reciprocation of the slide-out unit relative to the vehicle.

Recreational vehicles, including motor homes, fifth wheel trailers and travel trailers may be provided with an extendible slide-out unit for increasing the vehicle's living space. This slide-out unit may be extended for use when the vehicle is parked and is retracted in a telescoping manner when the vehicle is to be moved.

Prior vehicle slide-out installations that include an extension/retraction system that relies on screws or a pinion for effecting telescoping movement of the slide-out unit relative to the vehicle are known. Screws, in particular, must be short for practical reasons, including the tendency of a longer screw to deflect so that the axis of the screw is not absolutely straight. This, of course, greatly impairs operability of the screw. Pinions must also be comparatively short for practical reasons, including excessive weight in a pinion of greater length. Since the amplitude of movement of the slide-out room or compartment can be no greater than the length of the screw or pinion, the amplitude of sliding movement, and hence the amount of additional space gained by the slide-out compartment, is limited.

Other types of slide-out installations for vehicles are also known. One such installation employs an endless cable that passes over one pair of pulleys supported by a main part of a mobile home and a second pair of pulleys mounted on sidewalls of an extension part of the mobile home to cause the extension part to reciprocate. Another slide-out installation shows an expanding caravan, which also includes a rotatable shaft and two types of cables wound there around. Rotation of the shaft in one direction causes one type of cable to wind as the other type unwinds, causing a sliding unit to reciprocate in one direction (say, outwardly) relative to the vehicle. Rotation of the shaft in the opposite direction causes the sliding unit to move in the opposite direction (say, inwardly relative to the vehicle).

A challenge with slidable room assemblies is that a slide-out room is cantilevered as it is extended. The outer end of the extended slide-out room tends to tip downwardly. This puts weight on the slide-out unit's operating mechanism. The cantilevered slide-out room also tends to be loose at the top and tight at the bottom. This puts weight on the slide-out mechanism, which, in turn, impairs slidability and also invites leakage.

Another challenge with presently known slide-out units is that they require modification of the vehicle's underframe, unless the slide-out unit is of small size. For example, it may sometimes be necessary to cut away a portion of the underframe in order to accommodate the operating mechanism of the slide-out unit. This impairs the ability of the underframe to support the vehicle by lessening the strength and rigidity of the underframe.

**SUMMARY**

The embodiments described herein.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The following figures are included to illustrate certain aspects of the present disclosure, and should not be viewed as exclusive embodiments. The subject matter disclosed is capable of considerable modifications, alterations, combinations, and equivalents in form and function, without departing from the scope of this disclosure.

FIG. 1 is an isometric side view of an exemplary recreational vehicle having a slide-out unit in accordance with the present disclosure where the slide-out unit is in the retracted position.

FIG. 2 is an isometric side view of the exemplary recreational vehicle of FIG. 1, illustrating the slide-out unit in the extended position.

FIG. 3 is an isolated isometric top view of the exemplary slide-out unit of FIG. 2, illustrating the slide-out unit forming a room extension when in the extended position.

FIG. 4 is an isometric side view illustrating certain aspects of an exemplary slide-out drive assembly, according to one or more embodiments.

FIG. 5A is a close up isometric view of a first area identified as area X in FIG. 4.

FIG. 5B is a close up isometric view of a second area identified as area Y in FIG. 4.

FIG. 5C is a close up isometric view of a third area identified as area Z in FIG. 4.

FIGS. 6A-6C illustrate side views of the slide-out drive assembly of FIG. 4 as it articulates a slide-out room from the retracted position to the extended position.

FIGS. 7A-7H illustrate various views of the slide-out drive assembly of FIG. 4 arranged within an exemplary jamb member according to one or more embodiments.

FIGS. 8A-8H are detailed views of the drive chain assemblies utilized with the slide-out drive assembly of FIG. 4, according to one or more embodiments.

FIG. 9 illustrates a pair of mounting brackets utilized to attach the drive chain assemblies of FIGS. 8A-8E to a slide-out unit, according to one or more embodiments.

FIGS. 10A-10C illustrate alternate embodiments of the slide-out drive assembly of FIG. 4.

FIGS. 11A-11B illustrate alternate embodiments of the slide-out drive assembly of FIG. 4 utilizing multiple motors.

FIGS. 12A-12C illustrate alternate embodiments of the slide-out drive assembly of FIG. 4 that include drive extension assemblies, according to one or more embodiments.



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FIGS. 13A-13B illustrate alternate embodiments of the slide-out drive assembly of FIG. 4 that include timing shafts, according to one or more embodiments.

FIG. 14 illustrates a slide-out drive assembly configured to articulate the slide-out room between a retracted and extended position via a plurality of drive cables, according to one or more embodiments.

FIG. 15A illustrates an exemplary jamb assembly of FIG. 14 wherein the drive cables are actuated via a drive chain, according to one or more embodiments.

FIG. 15B illustrates a close up of an upper end of the jamb assembly of FIG. 15A.

FIG. 15C illustrates a close up of a lower end of the jamb assembly of FIG. 15A.

FIG. 15D illustrates a close up of a middle portion of the jamb assembly of FIG. 15A.

FIG. 16 illustrates an exemplary jamb assembly of FIG. 14 wherein a screw drive assembly actuates the drive cables, according to one or more embodiments.

FIG. 17A illustrates a close up of an upper end of the jamb assembly of FIG. 16.

FIG. 17B illustrates a close up of a lower end of the jamb assembly of FIG. 16.

FIG. 17C illustrates a close up of a middle portion of the jamb assembly of FIG. 16.

FIG. 18A illustrates an exemplary routing of drive cables that may be utilized with the jamb assembly of FIG. 16.

FIG. 18B illustrates an exemplary drive nut that may be utilized to organize the routing of drive cables illustrated in FIG. 18A.

FIG. 19 illustrates another exemplary jamb assembly of FIG. 14 wherein a screw drive assembly actuates the drive cables, according to one or more embodiments.

FIG. 20A illustrates a close up of an upper end of the jamb assembly of FIG. 19.

FIG. 20B illustrates a close up of a lower end of the jamb assembly of FIG. 19.

FIG. 20C illustrates a close up of a middle portion of the jamb assembly of FIG. 19.

FIG. 21A illustrates an exemplary routing of drive cables that may be utilized with the jamb assembly of FIG. 19.

FIG. 21B illustrates an upper side of an exemplary drive nut that may be utilized to organize the routing of drive cables illustrated in FIG. 21A.

FIG. 21C illustrates the lower side of the drive nut of FIG. 21B.

FIG. 22 illustrates an exemplary tracking roller assembly that may be utilized with any of the foregoing jamb assemblies to evenly guide the slide-out room between the left and right jamb assemblies and maintain the slide-out room centered within the opening of the vehicle.

FIG. 23 illustrates an alternate screw drive assembly configured to actuate the drive cables to extend or retract the slide-out room from a vehicle, according to one or more embodiments.

FIG. 24 illustrates a drive nut and drive cables of the screw drive assembly of FIG. 23, according to one or more embodiments.

FIG. 25 illustrates a block and tackle drive assembly configured to articulate the slide-out room, according to one or more embodiments.

FIG. 26 illustrates a close up of one of the block and tackle assemblies of FIG. 25.

FIG. 27 illustrates a close up of the moving blocks and drive chain of FIG. 26.

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FIGS. 28A-28C illustrate a cable drive assembly that may be incorporated with the jamb assemblies to move the slide-out room between an extended and retracted position.

FIGS. 29A-29C illustrate an alternate cable drive assembly that may be incorporated with the jamb assemblies to move the slide-out room between an extended and retracted position.

FIGS. 30A-30G, FIGS. 31A-31D, FIGS. 32A-32B, FIGS. 33A-33B, FIGS. 34A-34C, and FIGS. 35A-35C illustrate various means for adjusting tension in the drive chain and/or drive cables.

## DETAILED DESCRIPTION

The present disclosure is related to slidable unit assemblies and, more particularly, to drive mechanisms for slide-out rooms and slide-out compartments for vehicles.

The embodiments described herein provide a slide-out unit (i.e., a slide-out room, a slide-out compartment, etc.) having a pair of synchronized drive mechanisms that are installed at opposing sides or walls of the room and each configured to drive the room at a top and a bottom corner thereof relative to the vehicle. In some embodiments, these synchronized drive mechanisms each include a jamb that houses a sprocket that drives a drive chain that is attached to a side of the slide-out unit. Other embodiments described herein provide a pair of synchronized drive mechanisms that utilize one or more gears and corresponding racks instead of the foregoing sprockets and corresponding drive chains. In even other embodiments described herein, a pair of synchronized drive mechanisms each include a jamb with a pair of sprockets provided therein, where a timing belt is arranged on the pair of sprockets within the jamb, and a plurality of drive cables are connected to the timing belt and extend from the jamb to connect to the room.

FIGS. 1-3 illustrate an example vehicle 10 that may incorporate the principles of the present disclosure. The depicted vehicle 10 is just one exemplary vehicle that may incorporate the principles of the present disclosure. Indeed, many alternative designs and configurations of the vehicle 10 may be employed without departing from the scope of this disclosure. For example, the vehicle 10 may be a motor home, a fifth wheel trailer, a travel trailer, a utility trailer, or various other types of recreational or non-recreational vehicles. In addition, the vehicle 10 may be one that is designed for living (e.g., as a house trailer) or one that may be designed for work (e.g., a mobile office or library). Accordingly, the vehicle 10 may be a self-powered vehicle or may be a trailer that is adapted to be towed, for example, by an automobile or a truck.

As illustrated, the vehicle 10 includes a body 12 and a slide-out room 22 that is configured to slide relative to the body 12 between a retracted position (FIG. 1) and an extended position (FIGS. 2-3). The body 12 defines an interior space (not shown) within which the occupants of the vehicle 10 may live and/or work, and this interior space may be expanded via one or more slide-out rooms and/or slide-out compartments, such as the slide-out room 22. While these figures illustrate the vehicle 10 having a single extendible slide-out room 22, in other embodiments, it may include more than one extendible slide-out rooms and/or compartments.

The vehicle body 12 may comprise a plurality of exterior walls, for example, a roof (obscured from view), a front wall 14, a left sidewall 16, a right sidewall (obscured from view), and a rear wall (obscured from view). Additionally, the interior of the vehicle body 12 also includes a floor (not



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shown). Beneath the floor is a conventional frame (not shown) for supporting the vehicle body 12, and that frame may be either a conventional or a nonconventional frame.

In the illustrated embodiments, the left sidewall 16 includes an opening 18 and a jamb 20. As illustrated, the jamb 20 extends along the vertical and horizontal edges of the opening 18 and receives the slide-out room 22. The opening 18 in the left side 16 of the vehicle body 12 may have any number of geometries depending upon the geometry of the slide-out room 22 and, in the illustrated embodiments, the opening 18 is rectangular and has a perimeter that includes horizontal top and bottom edges and vertical side edges. The jamb 20 is illustrated as being a rectangular structure continuously disposed along these edges, however, in other embodiments, the jamb 20 may include discrete jamb portions that each correspond to one or more of the foregoing edges.

As described below, the slide-out room 22 may be provided with an actuation system or drive mechanism that reciprocates it between the retracted and extended positions. In some embodiments, a portion of the drive mechanism is housed within the jamb 20. As illustrated, for example, the jamb 20 includes a left jamb 20a and a right jamb 20b that each houses a portion of the drive mechanism; however, in other embodiments, the drive mechanisms are differently housed, for example, in the bottom and/or top jamb portions. Thus, drive mechanisms may be provided in any or all of the left jamb 20a, the right jamb 20b, the bottom jamb, and/or the top jamb.

In some embodiments, the vehicle 10 may further include one or more additional or auxiliary slide-out compartments. As illustrated in FIGS. 1-2, the body 12 includes a lower portion or skirt 24 that is disposed below the floor of the vehicle 10 and which terminates in a lower edge 26; and, in such embodiments, slide-out compartments may be arranged within the skirt 24. Either or both of the left sidewall 16 and/or the right sidewall (obscured from view) may include an opening 28 for receiving an auxiliary slide-out unit and, in the illustrated embodiment, the left sidewall 16 includes a slide-out compartment 30. As will be appreciated, an actuating system or drive mechanism (not illustrated) is provided for reciprocating the slide-out compartment 30 between extended and retracted positions, and, in some embodiments, such drive mechanism is similar to that utilized to actuate the slide-out room 22. However, it will be appreciated that the drive mechanism of the slide-out compartment 30 may be smaller and less powerful in embodiments where the slide-out compartment 30 is lighter than the slide-out room 22. It will also be appreciated that there may be any number of such openings 28 equal to the number of the slide-out compartments 30, and that the openings 28 may be of any number of geometries depending on the geometry of the slide-out compartment 30. Moreover, the opening 28 (or any of them) may be located at various locations about the body 12 and, in the illustrated embodiment, the opening 28 is disposed along the lower edge 26 of the left sidewall 16.

The vehicle 10 may have various arrangements of slide-out rooms and/or compartments. In the illustrated embodiments, for example, the vehicle 10 includes one extendible slide-out room 22 and one extendible slide-out compartment 30. In other non-illustrated embodiments, the vehicle 10 may include two or more of the slide-out rooms 22 and/or two or more slide-out compartments 30. However, it will also be appreciated that the vehicle 10 may include one or more slide-out rooms 22 without any slide-out compartments 30, and vice versa. Regardless of the exact configu-

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ration, it will be appreciated that the slide-out rooms and compartments 22,30 should always be retracted when the vehicle 10 is in motion. And, when the vehicle 10 is parked or stationary, the slide-out room 22 may be articulated into its extended position (FIGS. 2 and 3) to afford additional space within the interior of the vehicle 10. Similarly, the slide-out compartment 30 may be actuated when the vehicle 10 is at rest.

As illustrated, the slide-out room 22 may generally have the same cross-sectional shape as the opening 18 in the vehicle body 12; and, while the same may be true of the slide-out compartment 30 and the opening 28, the remainder of this disclosure is made with reference to the slide-out room 22. In the illustrated embodiments, the slide-out room 22 includes a floor (obscured in figures), a ceiling 32, a left sidewall 34 and a right sidewall 36 (as viewed from the exterior of the vehicle 10 looking in), and a forward or outside wall 38. In some embodiments, the slide-out room 22 may include one or more windows arranged on any of the ceiling 32, the left sidewall 34 and/or the right sidewall 36, and/or the outside wall 38. For example, the slide-out room 22 is illustrated as including a left and right window 34',36' on the left and right sidewalls 34,36, respectively, as well as a front window 38' on the outside wall 38. For reference, the four corners of the slide-out room 22 are referenced using letters A, B, C, and D, as shown in FIGS. 1-3.

As illustrated, the outside wall 38 of the slide-out room 22 is substantially coplanar or flush with (but may be spaced slightly outward from) the left sidewall 16 of the vehicle body 12 when the slide-out room 22 is retracted (FIG. 1), and is parallel to and spaced outwardly from the left sidewall 16 of the vehicle body 12 when the slide-out room 22 is extended (FIG. 2). In addition, the right sidewall 36 is disposed in a rearward direction of the vehicle body 12, and the left sidewall 34 is disposed in a forward direction of the vehicle body 12. The spacing between the left and right sidewalls 34,36 is slightly less than a width of the opening 18 in the vehicle body 12, which affords enough clearance for sliding movement of the slide-out room 22 while minimizing the intrusion of the elements into the vehicle body 12 such as wind and rain. As will be appreciated, the size of the outside wall 38 may be slightly greater than the size of the opening 18 (with the jamb 20) in the vehicle body 12 so that the edges of the outside wall 38 overlie the vehicle body 12 as an aid in maintaining an effective seal when the slide-out room 22 is retracted. In addition, one or more seals (not shown) may be provided around the perimeter of the opening 18 in a similar fashion to provide an effective means for sealing the slide-out compartment 30 when retracted within the vehicle body 12.

In certain embodiments, for example, where manual operation and/or manual servicing is desired, one or more handles 40 may be provided on the front wall of the slide-out room 22, so that the slide-out room 22 may be opened and closed manually. In at least some of these embodiments, a lock 42 may be provided to selectively secure the slide-out room 22. Moreover, the lock 42 may be provided in addition to the functioning of the actuation system or drive mechanism (detailed below) to lock the slide-out room 22 in position when it is at rest (whether retracted, extended or in-between). Similarly, the slide-out compartment 30 may be provided with a handle 44 for manual operation and a lock 46, as detailed with reference to the slide-out room 22.

In the illustrated embodiments, however, the slide-out room 22 is driven with a slide-out drive assembly that transmits force to the slide-out room 22 resulting in smooth, even actuation of the slide-out room 22 along its predeter-



mined path, with no tendency to twist or bind and with minimum power input. In these embodiments, the slide-out drive assembly transmits force evenly to the opposing left and right sidewalls **34,36** of the slide-out room **22**, whereas in other embodiments force may be transmitted to either or both of the ceiling **32** and/or the floor (not shown) of the slide-out room **22**. In even other embodiments, the slide-out drive assembly may transmit force evenly to the opposing left and right sidewalls **34,36** and either or both of the ceiling **32** and/or the floor of the slide-out room **22**.

One exemplary drive assembly is illustrated in FIG. **4**, and this exemplary slide-out drive assembly generally includes drive mechanism elements (e.g., drive chains and drive sprockets) and timing mechanism elements (e.g., timing chains, timing sprockets, etc.); however, the drive assembly may be configured differently as hereinafter described with reference to FIGS. **10-13** and/or with reference to FIGS. **14-35**. For example, the drive mechanism elements of the slide-out drive assembly may include pinion and rack gears instead of chains and sprockets, or the drive mechanism elements of the slide-out drive assembly may include drive cables. And, as will be appreciated with reference to FIGS. **7A-7H**, these drive mechanism elements and timing mechanism elements are at least partially arrangeable within one or more jambs/housings (not illustrated in FIGS. **4-6**) that are secured to the vehicle body **12**, for example, the interior of the left and right jambs **20a,b** that are secured to the left sidewall **16**.

FIG. **4** is an isometric side view of an exemplary slide-out drive assembly **402** according to one or more embodiments of the present disclosure. More specifically, FIG. **4** illustrates a right side **402b** of the exemplary slide-out drive assembly **402** engaging and transmitting force to the right sidewall **36** of the slide-out room **22**, but without the right jamb **20b** that may be included to house certain components of the slide-out drive assembly **402** and secure the same to the vehicle body **12**. It will be appreciated, however, that a left side slide-out drive assembly **402a** (not illustrated) may be similarly arranged on the left sidewall **34** of the slide-out room **22** to ensure even and uniform actuation along the opposing left and right sidewalls **34,36** of the slide-out room **22**.

As illustrated in FIG. **4**, the right side slide-out drive assembly **402b** includes a pair of drive members configured as a pair of drive chain assemblies **404,406** that are installed at vertically spaced locations along the right sidewall **36** of the slide-out room **22**. The drive chain assembly **404** is installed along a lower portion of the slide-out room **22**, between the outside wall **38** and a rear frame **408** of the slide-out room **22**, and is engaged or driven as illustrated in FIG. **5A**. Accordingly, the drive chain assembly **404** is said to correspond with corner D of the slide-out room **22**, and the length that the drive chain assembly **404** extends (together with the other drive chain assemblies) generally defines the amount of extension that a slide-out unit may exhibit in a particular application. The drive chain assembly **404** is engaged or driven at a first area X (which has been enlarged in FIG. **5A**). The drive chain assembly **406** is similarly arranged, except that it is installed along an upper portion of the right sidewall **36** (between the outside wall **38** and the rear frame **408**) and is thus said to correspond with the corner B of the slide-out room **22**. Thus, the drive chain assembly **406** is engaged or driven at a second area Y (which has been enlarged in FIG. **5B**). In addition, FIG. **4** shows the drive chain assemblies **404,406** being constrained or slidingly attached to the right sidewall **36**, for example, as illustrated with the drive chain assembly **404** being attached

thereto to a third area Z (which has been enlarged in FIG. **5C**). It will be appreciated that the drive chain assembly **406** may be similarly configured as illustrated with respect to the drive chain assembly **404** in FIG. **5C**. And, while not illustrated, it will be appreciated that the left side slide-out drive assembly **402a** may include similarly arranged drive chain assemblies disposed along the left sidewall **34** so as to correspond with the corners C,A of the slide-out room **22**. The drive chain assemblies, such as the drive chain assemblies **404,406**, are further described below, for example, with reference to FIGS. **8A-8H**.

As illustrated in FIGS. **5A-5B**, the right side slide-out drive assembly **402b** includes a pair of drive chain sprockets **410,412** that engage the drive chain assemblies **404,406**, respectively. Here, the drive chain sprocket **410** is a lower drive chain sprocket and the drive chain sprocket **412** is an upper drive train sprocket. More specifically, the drive chain sprocket **410** engages a lower drive chain (obscured; see, for example, FIGS. **8A** and **8C**) that is set within a channel member **414** of the (lower) drive chain assembly **404**, whereas the drive chain sprocket **412** engages an upper drive chain (obscured; see, for example, FIGS. **8A** and **8C**) that is set within a channel member **416** of the (upper) drive chain assembly **406**. It will be appreciated that, as the drive chain sprockets **410,412** may each engage their respective drive chain (not shown) from beneath, the channel members **414,416** may be supported from above by a respective roller member **418** extending from a roller shaft **420**. In particular, FIG. **5A** illustrates the engagement of the drive chain assembly **404** between the drive chain sprocket **410** and the first roller member **418**, and FIG. **5B** illustrates the engagement of the second drive chain assembly **406** between the second drive chain sprocket **412** and the second roller member **418**. Where utilized, either or both of the roller members may be connected to the drive chain assemblies **404,406**, for example, via their respective roller shaft **420**.

As illustrated in FIG. **5A**, the drive chain sprocket **410** is disposed on a drive shaft **422** that is actuated by a motor **424** such that the drive chain sprocket **410** rotates with the drive shaft **422**. In the illustrated embodiment, a gear box **426** is utilized to transfer power (i.e., torque) from an output shaft (not shown) of the motor **424** to the drive shaft **422** that rotates the drive chain sprocket **410**. In this example, the gear box **426** is a worm gear box; however, it will be appreciated that other gear boxes may be utilized, for example, bevel gear boxes. In addition, while various types of actuators or motors may be utilized, in at least some embodiments, the motor **424** is either a self-locking worm drive or a planetary gear motor with an electric brake. Also in the illustrated embodiment, each side **402a,b** of the slide-out drive assembly **402** includes an actuator, such as the motor **424**. In such embodiments that utilize more than one actuator or motor, the actuators or motors may be synchronized with each other to ensure even and uniform articulation at all sides/corners of the slide-out room **22**, for example, using Hall Effect sensors (not illustrated) that may be arranged to count revolutions of the motor **424**.

The actuators such as the motors **424**, or any of them, may be powered by the vehicle, include a battery (e.g., a rechargeable battery), or be connected to a renewable power source such as a solar powered generator, a vehicle mounted wind turbine generator, etc. Alternatively, a portable motor or a hand crank may be used instead of the motor **424** and/or gear box **426**. Whatever form of power input is used, however, the slide-out room **22** may be locked in position when it is not in motion. When used, a worm drive performs a locking function when the slide-out room **22** is at rest,



locking the slide-out room 22 in place (for example, in a closed position when fully retracted), so that a separate lock is not necessary. With other drive mechanisms, a locking means (e.g., a cam lock, or clamp in the walls of slide-out unit 22) may be used to retain the slide-out room 22 in position.

A timing sprocket (obscured from view behind the gear box 426) may be provided on the drive shaft 422 such that the timing sprocket rotates with the drive chain sprocket 410 and the drive shaft 422 (at corner D of the slide-out room 22). Here, the timing sprocket interposes the drive chain sprocket 410 and the gear box 426, and receives a timing chain or timing belt 428. A timing sprocket may be utilized, for example, in embodiments where the right side slide-out drive assembly 402b includes a single actuator, such as the motor 424, such that the motor 424 may be utilized to drive the (lower and upper) drive chain assemblies 404,406 together and in unison (i.e., to “time” the drive chain assemblies 404,406 so that they are driven simultaneously).

As illustrated in FIG. 5B, the drive chain sprocket 412 is similarly disposed on a drive shaft 430 (corresponding to corner B) so that the drive chain sprocket 412 rotates with the drive shaft 430. In addition, a timing sprocket 432 is also similarly disposed on the drive shaft 430 to rotate with the drive chain sprocket 412 and to receive the timing belt 428, and the timing sprocket 432 may be secured thereon at a location that corresponds with the location of the timing sprocket (obscured from view) on the drive shaft 422 as described with reference to FIG. 5A. Accordingly, the timing belt 428 couples the (first) drive shaft 422 to the (second) drive shaft 430 such that a rotation of the (first) drive shaft 422 rotates the (second) drive shaft 430, and vice versa. As will be explained in more detail below, the motor 424, the timing belt 428, portions of the drive shafts 422,430, and portions of the roller shafts 420 may be arranged within a structure, such as the jamb 20, so that the drive chain sprockets 410,412 and the roller members 418 protrude therefrom to engage the drive chain assemblies 404,406 as illustrated in FIGS. 5A and 5B.

The timing belt 428 synchronizes rotation of the lower and upper drive shafts 422,430 such that the lower and upper drive sprockets 410,412 engage the lower and upper drive chain assemblies 404,406, respectively, in unison. It will be appreciated, however, that the forgoing timing mechanisms are optional, and that each of the drive chain assemblies 404,406 could be driven by a discrete motor, which may be synchronized (e.g., a lower and an upper motor that are synchronized with each other via a Hall Effect sensor or feedback). In other embodiments, it will be appreciated that the slide-out drive assembly 402 may instead drive the slide-out room 22 without any timing components, for example, at a single side, a pair or more of sides, or at a pair or more of corners (e.g., at the corners C and D of the slide-out room 22). In even other embodiments, a timing shaft and a set of bevel gears operatively connected thereto may be utilized in lieu of the foregoing timing components (e.g., the timing belt 428 and the timing sprockets 432).

FIG. 5C illustrates how the drive chain assembly 404 may be secured to the right sidewall 36 of the slide-out room 22 according to one or more embodiments. While only illustrating the (lower) drive chain assembly 404, it will be appreciated that the same may similarly apply with regard to the (upper) drive chain assembly 406 or other drive chain assemblies that may be installed on the left sidewall 34 or elsewhere about the slide-out room 22. In the illustrated embodiment, a support bracket or bracket 450 is utilized to secure an end of the drive chain assembly 404 that is

proximate to the rear frame 408 of the slide-out room 22. When installed on the slide-out room 22 (e.g., on the right sidewall 36) over the channel member 414, the bracket 450 defines an interior space or channel 452 having a vertical dimension “H” (i.e., a height) that is greater than a vertical dimension “h” of the channel member 414, which is being bracketed against the vehicle body 12 via the bracket 450. This arrangement permits relative movement of the channel member 414 within the bracket 450, for example, when the slide-out room 22 is extended and/or “dropped” as described below.

As illustrated in FIGS. 6A-6C, the slide-out drive assembly 402 actuates the slide-out room 22 from a fully retracted position (FIG. 6A), along a predetermined path (an intermediate position of the predetermined path is illustrated in FIG. 6B), and to a fully extended position (FIG. 6C). When the slide-out unit 22 is fully retracted within the vehicle 10, as illustrated in FIG. 6A, it rides up above an interior floor 460 of the vehicle 10. The interior floor 460 of the vehicle 10 may include a slide-out extension slot 462 leading inwardly from the opening 18 and into a lip 464 of the interior floor 460, and the slide-out room 22 sits on the lip 462 when retracted within the vehicle 10 and slides upon the lip 462 as it extends outward from the opening 18 of the vehicle 10. The slide-out room 22 includes a floor 466 and, in this embodiment, the floor 466 includes a lip engagement member 468 that extends beyond the rear frame 408 of the slide-out room 22. Here, the lip engagement member 468 has an upwardly inclined/sloped face 470 that engages a mating surface 472 of the lip 462 and, as will be appreciated, this facilitates providing the slide-out room 22 in a fully extended position where its interior floors (not shown) are substantially coplanar with the interior floors (not shown) of the vehicle 10. In addition, the sloped face 470 of the engagement member 468 facilitates the engagement member 468 riding along and over the mating surface 472 of the lip 462, for example, when the slide-out room 22 is articulated from a fully extended position to a retracted position. It will all be appreciated that all of the forgoing contact surfaces, for example, of the lip 462, the engagement member 468 and its sloped face 470 may all have lubricious contact surfaces (or other low friction surface finishes) that facilitate smooth articulation.

During operation, securing the drive chain assembly 404 to the slide-out room 22 with the bracket 450 (that permits relative motion as previously described) facilitates the slide-out room 22 to “drop” into the extended position illustrated in FIG. 6C. For example, the floor 466 of the slide-out room 22 travels along the lip 464 until the lip engagement member 468 guides the slide-out room 22 downward along its sloped face 470 that interacts with the mating surface 472 of the lip 464 on the interior floor 460 of the vehicle 10. In this example, when the slide-out room 22 is in the fully extended position (FIG. 6C), the sloped face 470 of the lip engagement member 468 is fully engaged with the mating surface 472 of the lip 464. The bracket 450 permits relative motion between the slide-out room 22 and slide-out drive assembly 402 that is secured to the vehicle body 12 such that the drive assembly 402 is not damaged when the slide-out room 22 “drops” into its extended position (i.e., when the slide-out room 22 moves vertically relative to the remainder of the vehicle body 12). In this manner, as the slide-out room 22 is fully extended from the vehicle, the sloped face 470 of the lip engagement member 468 rides over and down past the lip 464 such that the interior floor (not shown) of the slide-out room 22 is substantially coplanar with the interior floor (not shown) of the vehicle 10.



As previously mentioned, aspects of the slide-out drive assembly **402** may be provided within a jamb structure that is secured to the vehicle body **12**. FIGS. 7A-7H illustrate portions of the right side slide-out drive assembly **402b** arranged within the right jamb **20b** according to one or more 5 embodiments. In such embodiments, it will be appreciated that the left jamb **20a** (and/or any other jamb structure(s) disposed around the opening **18**) may be similarly arranged. The right jamb **20b** includes a jamb member **702**. In the illustrated embodiment, the jamb member **702** is an elongated extrusion having a lower end **704** (corresponding to the corner D) and an upper end **706** (corresponding to the corner B). The jamb member **702** includes a web portion **708** and a pair of legs **710,712** extending from a bottom side of the web portion **708** such that the jamb member **702** has a “C” shape cross-section and defines an interior channel **714**, and the interior channel **714** may be utilized to both connect the right jamb **20b** to the vehicle body **12** and/or to house at least some (or a portion of some) of the right side slide-out drive assembly **402b** components as described below. In the illustrated embodiment, the second leg **712** is shorter than the first leg **710** of the jamb member **702** due to the manner in which the right jamb **20b** is secured to the vehicle body **12** via a jamb clamp **730**. However, the jamb member **702** may be differently dimensioned or configured depending on the vehicle **10** to which it is to be attached.

In the illustrated embodiments, a pair of channel frames **720,722** are provided within the channel **714** at the lower and upper ends **704,706** of the jamb member **702**, respectively. It will be appreciated that while the channel frames **720,722** were not depicted in FIGS. 5A-5B, respectively, structures such as the channel frames **720,722** may be utilized to position and/or secure the drive shafts **422,430**, roller shafts **420**, and/or the motor **424**, and/or other components relative to the drive chain assemblies **404,406**.

Here, each of the channel frames **720,722** is illustrated as being open rectangular cross-section members each having a rear face **724** and a front face **726**. In some embodiments, the channel frames **720,722** are disposed within the channel **714** so that each face **724,726** is contained within the envelope defined by the jamb member **702**. In other embodiments, the web portion **708** is formed with a recess **728** sized to receive the front face **726** as best shown in FIGS. 7F-7H. However, either or both of the channel frames **720,722** may instead be single frame members spanning approximately parallel to the web portion **708**, or instead be “C” shaped cross-section members that are oriented within the channel **714** such that the “C” shape cross-section of the channel frames **720,722** is 180 degrees opposite of the “C” shaped cross-section of the jamb member **702**; and, in this manner, the channels **720,722** will not be nested within the jamb member **702**. Rather, the channels **720,722** each include a rear face **724** that together define a rear boundary of the channel **714**. Alternatively, the channel frames **720,722** may be a planar member similarly disposed within the channel **714** as the foregoing “C” shaped cross-section members.

The jamb clamp **730** may be provided to secure the jamb member **702**, for example, to the vehicle body **12**. In the illustrated embodiment, the jamb clamp **730** includes a first flange **732** that is arranged to correspond with (or nest within) a mating recess of the second leg **712** (of the jamb member **702**); a web portion **734** that extends from the first flange **732** in a substantially coplanar orientation relative to the web portion **708** (of the jamb member **702**); and a second flange **736** that extends from the web portion **734** in a substantially coplanar orientation relative to the first leg **710** (of the jamb member **702**). As will be appreciated, the first

flange **732** of the jamb clamp **730** may be secured to the first leg **710** of the jamb member **702** via a friction press-fit as illustrated; however, it may be differently secured or include additional securing methods such as, for example, by use of welding, fasteners, adhesives, etc. Accordingly, the jamb clamp **730** may be utilized to wedge or clamp a portion of the vehicle body **12** within the jamb **20**.

Either or both of the channel frames **720,722** within jamb member **702** may have an upper and/or lower aperture (both obscured from view) that extend through the rear and front faces **724,726** thereof. FIG. 7F illustrates an example where these apertures formed into the rear faces **724** of the (lower and upper) channel frames **720,722**; whereas FIG. 7G illustrates these apertures formed into the front faces **726** of the same. As will be appreciated, these apertures are arranged to receive one of the drive shafts **422,430** and/or the roller shafts **420**. In other embodiments, however, the drive shafts **422,430** and/or the roller shafts **420** extend from the right sidewall **36** of the slide-out room **22** rather than jamb assembly as previously described. In other embodiments, the channel frames **720,722** are arranged to receive only the drive shafts **422,430**, and the roller shafts **420** are secured to the jamb **20**, for example, at the web portion **708**.

In the illustrated embodiment, the (lower) channel frame **720** includes an aperture that receives the drive shaft **422**. In some embodiments, the channel frame **720** includes a second aperture that receives the roller shaft **420**. Regardless, it will be appreciated that a rear end of each of the roller shaft **420** and the drive shaft **422** may extend to or beyond the rear face **724**, and a front end of each of the roller shaft **420** and the drive shaft **422** extends beyond the front face **726** and outward of the web portion **708** to receive the roller member **418** and the drive chain sprocket **410**. With this arrangement, the (lower) drive chain assembly **404** is secured between the (lower) roller member **418** and the (lower) drive chain sprocket **410** when driven via the (lower) drive chain sprocket **410**. Also in this embodiment, the timing sprocket (not illustrated) on the (lower) drive shaft **422** that engages the timing belt **428** is disposed between the rear and front faces **724,726**. In addition, the motor **424** and gear box **426** may be similarly disposed between the rear and front faces **724,726**, or may instead be disposed proximate to an outside of the rear face **724**. Also, additional sprockets or gears may be provided on the (lower) drive shaft **422**, for example, an extra sprocket **434** that may be utilized to engage a drive extension assembly as detailed below.

Similarly, the (upper) channel frame **722** may also include one or more apertures to receive the drive shaft **430** and/or the roller shaft **420** as previously described with reference to the (lower) channel frame **720**. Thus, a rear end of each of the roller shaft **420** and the drive shaft **430** may extend to or beyond the rear face **724**, and a front end of each of the roller shaft **420** and the drive shaft **430** extends beyond the front face **726** and outward of the web portion **708** to receive the roller member **418** and the drive chain sprocket **412**. As such, the (upper) drive chain assembly **406** may be secured between the (upper) roller member **418** and the (upper) drive chain sprocket **412** when driven via the (upper) drive chain sprocket **412**. Also in this embodiment, the timing sprocket **432** on the (upper) drive shaft **430** that engages the timing belt **428** is disposed between the rear and front faces **724,726**. Also, additional sprockets or gears may be provided on the (upper) drive shaft **430**, for example, the extra (third) sprocket **434** may be utilized to engage an upper motor and/or a drive extension assembly as detailed below.

Turning to FIGS. 8A-8F, various views of the drive chain assemblies **404,406** are illustrated according to one or more



embodiments of the present disclosure. However, for ease of discussion, the drive chain assemblies **404,406** are each individually referred to as a drive chain assembly **802**. FIG. **8A** is an isometric side view of the drive chain assembly **802**. Here, the drive chain assembly **802** includes a channel member **804** (that is arranged similarly to the channel members **414,416** described with reference to FIGS. **5A-5B**) and a chain **806**. The channel member **804** may be an elongated extruded piece in some embodiment. While various designs or types of the chain **806** may be utilized, the chain **806** may include a plurality of connected links that are suitably arranged to engage the drive chain sprockets **410, 412**, as described above. And, in some embodiments, the chain **806** is a standard size roller chain as categorized by the American National Standards Institute (ANSI), for example, roller chain standard 40, 50, 60, or 80.

FIG. **8B** is a front view of the channel member **804** of FIG. **8A** without the chain **806** mounted therein, whereas FIG. **8C** illustrates the channel member **804** of FIG. **8B** with the chain **806** installed therein. As illustrated, the channel member **804** includes a pair of sidewalls **808,810** that extend from a web portion **812** of the channel member **804**, and a chain rail **814** arranged between the sidewalls **808,810** in a substantially coplanar orientation relative to the web portion **812** of the channel member **804** such that the sidewalls **808,810** extend past the chain rail **814**. The portions of the sidewalls **808,810** that extend past the chain rail **814** and the chain rail **814** together define a chain channel **816**. In addition, the sidewalls **808,810** and the chain rail **814** also define an inner recess or inner channel **818**. As illustrated, the chain channel **816** is arranged to receive the chain **806** and secure it within the channel member **804** such that it may be engaged with a drive chain sprocket such as the drive chain sprockets **410,412**, whereas the inner channel **818** is arranged to secure opposing ends of the chain **806** that extend from the chain channel **816**.

FIG. **8D** illustrates a side cut-away view of the drive chain assembly **802** along a section line A-A of FIG. **8C**, according to one or more embodiments. FIG. **8E** illustrates a top view of the drive chain assembly **802** of FIG. **8A**, whereas FIG. **8F** illustrates a bottom view of the drive chain assembly **802** of FIG. **8A**. In the illustrated embodiment, the chain **806** has a length that is longer than the length of the channel member **804** (i.e., longer than the chain rail **814**) such that when the chain **806** is disposed within the chain channel **816**, extra lengths of chain exist and extend out of the chain channel **816** at each end; these extra lengths of chain may then be wrapped around the chain rail **814** into the inner channel where they are secured to the channel member **804**, for example, via a pin **820**. In the illustrated embodiment, a pin **820** is utilized to secure the chain **806** to the channel member **804** at each end thereof by extending (i) through the web portion **812** of the channel member **804**, (ii) through the extra length of chain **806** that is wrapped into the inner channel **818**, (iii) through the chain rail **814**, and (iv) through a portion of the chain **806** disposed within the chain channel **816**. It will be appreciated, however, that other means may be utilized to secure the chain **806** to the channel member **804**. For example, the pin may extend through the web portion **812** and engage the chain **806** within the inner channel **818** with enough pressure such that the chain **806** is secured therein, similar to a press fit.

The channel member **804** may also include a mounting slot **830** at (at least) a first end **832** of the channel member **804**. The mounting slot **830** may be arranged to receive a mounting bracket pin as described below with reference to FIG. **9**. In the illustrated embodiment, however, a second

end **834** of the channel member **804** is configured to be attached to the slide-out room **22** via the bracket **450** as described above with reference to FIG. **5C**; however, the second end **834** may be similarly configured as with the first end **832**.

FIGS. **8G** and **8H** illustrate alternate embodiments of the drive chain assembly **802** according to one or more other embodiments. In particular, FIGS. **8G** and **8H** illustrate an embodiment where the chain **806**, or at least a portion of the chain **806**, may extend outward of the chain channel **816** to engage a drive member, such as a drive sprocket **852**, and be held within the chain channel **816** via a pair of chain guides **854**. In the illustrated embodiment, the drive sprocket **852** engages a top side of the chain **806** rather than engaging the underside of the chain **806**, as previously described with reference to FIGS. **8A-8F**. Here, either or both of the drive sprockets **410,412** may be arranged as the drive sprocket **852** of FIGS. **8G-8H**, where the drive sprocket **852** is offset or spaced from the channel member **804** such that its teeth or cogs engage a top side of the chain **806** at a location outside of the chain channel **816**. In these embodiments, the chain **806** rests within the chain channel **816**, but then exits the chain channel **816** to wrap around and engage at least a bottom portion of the drive sprocket **852**. In some embodiments, the drive chain assembly **802** may include one or more chain guides **854** and, in the illustrated embodiments, two such chain guides **854** are provided to maintain the chain **806** within the chain channel **816** when not engaged by the drive sprocket **852**. The chain guides **854**, where utilized, may have various configurations. For example, the chain guides **854** of FIG. **8G** are arranged as rollers, whereas the chain guides **854** of FIG. **8H** are arranged as sprockets. The chain guides **854** may be secured to the drive chain assembly **802** at, for example, the channel member **804** (e.g., at the sidewalls **808/810**). Alternatively, the chain guides **854** may be secured to the vehicle body **12**, for example, via the jamb **20** (e.g., connected to the channel member **702**). In even other embodiments, the chain guides **854** are coupled to the motor **424** and arranged to drive (or assist in driving) the slide-out room **22** as described herein; and in such configurations, the chain guides may be timed with the drive sprocket **852**. In addition, one or more roller members **418** may be provided to ensure engagement between the drive sprocket **852** and the drive chain assembly **802** as herein-before described, and such roller members **418** may each extend from the roller shaft **420** as previously described.

FIG. **9** illustrates a pair of mounting brackets **842** according to one or more embodiments. The mounting brackets **842** may be utilized to attach the first end **832** (and/or the second end **834**) of the drive chain assembly **802** to the slide-out room **22** as mentioned above. Here, each of the mounting brackets **842** includes a base **844** secured to the slide-out room **22** and a pin **846** extending outwardly therefrom. The base **844** may be attached to the slide-out room **22** via a number of fastening methods, for example, via utilization of fasteners or adhesives. The pin **846** is arranged within the mounting slot **830** such that the channel member **804** is able to rotate about the pin **846** relative to the plate **844** (and the slide-out room **22** secured thereto), thereby permitting the second end **834** to vertically translate within the channel **452** of the bracket **450** as described above with reference to FIG. **5C**. In some embodiments, the pin **846** is made from a lubricious material; however, in other embodiments, a bushing or sleeve may be provided between the pin **846** and the mounting slot **830** to facilitate smooth rotation. Accordingly, in the illustrated embodiment, the first end **832** of the drive assembly **802** is mounted to the slide-out room



22 via pin 846 that permits relative rotation (about the pin 846) between the slide-out room 22 and the vehicle structure 12, whereas the second end 834 of the drive assembly 802 is mounted to the slide-out room 22 via the bracket 450 that permits relative movement between the slide-out room 22 and the vehicle body 12 (in at least a vertical direction).

It will be appreciated that, while not illustrated, the left side slide-out drive assembly 402a may be arranged similar to the right side slide-out drive assembly 402b as described in FIGS. 4-9.

It will also be appreciated that in certain environments, it may be desirable to protect the drive chain assemblies from dirt, debris, and/or moisture. This may be true in embodiments where the drive chain assemblies are mounted to the ceiling or upper surface of slide-out room 22. To this end, a protective surface (not illustrated) may be utilized to cover vulnerable drive chain assemblies, for example, the chain 806 therein. The protective surface may be a thin membrane or have a suitably configured sleeve that travels along any portion of drive chain assembly, and/or the chain 806 disposed therein, that may be subject to the accumulation of unwanted material. However, it is appropriate that the protective surface not enter the engagement between a drive chain sprocket (e.g., 410,412) and a chain (e.g., the chain 806) in a drive chain assembly (e.g., 404,406). In some embodiments, a router (not illustrated) may be employed to channel the protective surface around such engagement and, in one such embodiment, the router includes a series of traveler members therein that help to move the protective surface away from the sprocket/chain engagement as the slide-out room 22 is moved between retracted and extended positions. Alternatively, the protective surface could be collected and dispensed via an arrangement of one or more spools in which such spools are biased and take up excess slack as the slide-out unit drive assembly actuates.

The slide-out drive assembly 402 may also be modified in a number of ways. For example, the motor 424 may be moved from its position that is proximate to the (lower) drive shaft 422 (as illustrated in FIGS. 4 and 5A) to an upper position proximate to the (upper) drive shaft 430 (as illustrated in FIGS. 10A and 10C), and/or the motor 424 may be inverted so that its cylindrically extending base portion extends upward (as illustrated in FIGS. 10B and 10C) rather than downward (as illustrated in FIGS. 4, 5A and 10A). It will be appreciated that the motor 424 (or any of them, if more than one) may be differently oriented to extend at angles other than those illustrated in the figures, as may be needed in a particular application.

FIG. 10A illustrates the right side of a slide-out drive assembly 1002 according to one or more other embodiments. Here, the motor 424 and gear box 426 are disposed at an upper portion of the right sidewall 36 so as to the (upper) drive shaft 430 instead of the (lower) drive shaft 422 as illustrated in FIG. 4. Here, the (lower) drive shaft 422 includes a timing sprocket 1004 disposed thereon in a similar manner in which the timing sprocket 432 is disposed on the (upper) drive shaft 430 in FIG. 4.

FIG. 10B illustrates a slide-out drive assembly 1010 according to one or more other embodiments. The slide-out drive assembly 1010 is similar to the slide-out drive assembly 402 illustrated in FIG. 4, except that the motor 424 and the gear box 426 are inverted so that a body of the motor 424 extends upwards as illustrated in FIG. 10B.

FIG. 10C illustrates a slide-out drive assembly 1020 according to one or more other embodiments. The slide-out drive assembly 1020 is similar to the slide-out drive assembly 1002 illustrated in FIG. 10A, except that the motor 424

and the gear box 426 are inverted so that a body of the motor 424 extends upwards in a similar fashion as described with reference to FIG. 10B.

As mentioned above, some embodiments described herein may utilize multiple motors 424. For example, each of the corners A,B,C,D may have an actuator associated therewith as illustrated in the example embodiment of FIGS. 11A-11B. These example embodiments utilize multiple actuators on each side of the slide-out drive assembly, such as a pair of motors 1104. Here, utilizing multiple motors eliminates the need for mechanical timing components (e.g. timing belts, shafts, or bevel gear arrangements) to synchronize or time the upper and lower motors 1104. Instead, the motors 1104 may be synchronized using Hall Effect sensors as detailed above or using logic (e.g., a programmable logic controller). Also, while embodiments described herein illustrate just one or two of the motors, it will be appreciated that in some applications it may be beneficial to utilize two or more motors 424 that are synchronized (or controlled with feedback) to drive either or both of the drive chain assemblies 404,406.

FIG. 11A illustrates a right side slide-out drive assembly 1102 that includes two motors 1104, according to one or more embodiments. Here, each of the motors 1104 includes a gear box 1106 integrally attached and extending from a base 1108 of the motor 1104. As will be appreciated, the gear box 1106 is arranged to transfer a rotation force (torque) to a shaft such as the drive shafts 422,430. It will be appreciated that in some applications it may be beneficial to utilize two or more motors 424 that are synchronized (or controlled with feedback) to drive either or both of the drive chain assemblies 404,406.

FIG. 11B is an alternate embodiment of a right side slide-out drive assembly 1120, according to one or more embodiments. Here, the right side slide-out drive assembly 1120 includes a pair of motors 1130 oriented with their bases extending downward. Each of the motors 1130 includes a bevel gear 1132 extending from a top side of the motor 1130. Each of the bevel gears 1132 is oriented to rotate around a vertical axis (of its corresponding motor 1130) and drives a mating bevel gear 1134 that engages the slide-out room 22 (e.g., at the drive chain assembly 404). One of the mating bevel gears 1134 is disposed on each of the lower and upper drive shafts 422,430, and arranged thereon so that the bevel gears 1134 each rotate with their corresponding one of the drive shafts 422,430. Accordingly, a rotation of the bevel gear 1132 around the vertical axis drives the mating bevel gear 1134 engaged therewith, which in turn causes the corresponding one of the drive shafts 422,430 to rotate. The drive chain sprockets 410,412 rotate with the drive shafts 422,430 and actuate the drive chain assemblies 404,406 that are attached to the right sidewall 36 of the slide-out unit 22.

Also in this embodiment, the drive shafts 422,430 may extend from the right sidewall 36 of the slide-out room 22 rather than jamb assembly as previously described. In addition, a roller 1138 may be provided with a shaft 1140 that similarly secures it to the right sidewall 36 of the slide-out room 22. In these embodiments, it will be appreciated that the first bevel gears 1134 is attached to a portion of the vehicle body 12, for example, via a jamb assembly.

FIG. 12A illustrates an alternate embodiment of a right side slide-out drive assembly 1202, according to one or more embodiments. Here, the right side slide-out drive assembly 1202 is similar to the right side slide-out drive assembly 402b of FIG. 4, except that the motor 424 utilizes a gear box 1204 having a first bevel gear 1204 that is arranged to engage and drive a second bevel gear 1206. The second



bevel gear 1206 is arranged on the drive shaft 422 such that they rotate together. Accordingly, the motor 424 transmits rotational force to the (lower) drive shaft 422 via bevel gear arrangement of the bevel gears 1204,1206. Also, the (upper) drive shaft 430 rotates with the (lower) drive shaft 422 via the timing elements such as the timing belt 428.

FIG. 12B illustrates an alternate embodiment of a right side slide-out drive assembly 1212, according to one or more embodiments. Here, the right side slide-out drive assembly 1212 is similar to the right side slide-out drive assembly 1202 of FIG. 12A, except that the present right side slide-out drive assembly 1212 includes a drive extension assembly 1214 that permits the motor 424 and the bevel gear box 1204' attached thereto to be located further away from the drive shafts 422,430. Here, the drive extension assembly 1214 includes a bevel drive gear 1216 disposed proximate to the bevel gear box 1204' so as to be engaged and driven thereby. The bevel drive gear 1216 is secured within a jamb structure (not illustrated) but in other embodiments may be secured to the sidewall 36 of the slide-out room 22. The drive extension assembly 1214 also includes an extension drive chain 1218 that couples the bevel drive gear 1216 to the (lower) drive shaft 422 so that they rotate with each other in unison. Thus, the drive chain 1218 wraps around an extension drive sprocket 1220 that is attached to (and rotates with) the bevel drive gear 1216, and also wraps around a corresponding sprocket 1222 that is disposed on the (lower) drive shaft 422 at a location thereon proximate to the drive chain sprocket 410. As such, the drive shaft 422 includes a pair of sprockets (i.e., the drive chain sprocket 410 and the sprocket 1222) and is thus sometimes referred to as a double sprocket configuration.

FIG. 12C illustrates an alternate embodiment of a right side slide-out drive assembly 1232, according to one or more embodiments. Here, the right side slide-out drive assembly 1232 is similar to the right side slide-out drive assembly 1212 of FIG. 12B, except that the motor 424 and the bevel gear box 1204' are instead oriented along the (upper) drive chain assembly 406 rather than along the (lower) drive chain assembly 404 as illustrated in FIG. 12B. Thus, the (upper) drive shaft 430 has the double-sprocket configuration in this embodiment because both the drive chain sprocket 412 and the sprocket 1222 that corresponds with the extension drive sprocket 1220 are disposed thereon.

In other embodiments, timing elements are utilized other than belts and chains. FIGS. 13A-13B, for example, each illustrate an alternate embodiment of a right side slide-out drive assembly 1302A,B that utilize a timing shaft 1304 rather than a belt or chain such as the timing belt 428, according to one or more embodiments. Here, the timing shaft 1304 is operatively connected to the motor 1306. Also disposed on the timing shaft 1304 are a pair of bevel gears 1310,1312 that rotate with the timing shaft 1304. The bevel gears 1310,1312 are disposed at opposing ends of the timing shaft 1304, for example, at locations thereon that correspond with the drive chain assemblies 404,406. Here, the roller members 418 and the drive shafts 422,430 are secured directly into the right sidewall 36 of the right hand slide-out room assembly 1302A. In addition, each of the drive shafts 422,430 include a bevel gear 1314,1316 arranged thereon such that the bevel gear 1314 rotates with the (lower) drive shaft 422 and the bevel gear 1316 rotates with the (upper) drive shaft 430. The drive shafts 422,430 are disposed proximate to the drive chain assemblies 404,406, such that the motor 1306 rotates the timing shaft 1304, which in turn causes the pair of bevel gears 1310,1312 attached thereto to rotate with the timing shaft 1304; and each of the pair of

bevel gears 1310,1312 engages and rotates its corresponding one of the bevel gears 1314,1316 such that the drive shafts 422,430 attached thereto rotate.

As illustrated in the example embodiment of FIG. 13A, the motor 1306 and the first bevel gear 1310 are disposed on the timing shaft 1304 proximate to the (lower) drive chain assembly 404 and the second bevel gear 1312 is disposed on the timing shaft 1304 proximate to the (upper) drive chain assembly 406. Similarly in the example embodiment illustrated in FIG. 13B, the motor 1306 and the first bevel gear 1310 are disposed on the timing shaft 1304 proximate to the (upper) drive chain assembly 406 and the second bevel gear 1312 is disposed on the timing shaft 1304 proximate to the (lower) drive chain assembly 404.

In these embodiments, a bushing 1320 and bushing bracket 1322 may be arranged on the timing shaft 1304 at locations thereon proximate to the first and second bevel gears 1310,1312 as a means of maintaining and/or securing the timing shaft 1304 in a position such that the bevel gear 1310 engages the bevel gear 1314 and so that the bevel gear 1312 engages the bevel gear 1316. The bushing 1320 may be secured to the timing shaft 1304 via a pin 1324 so that it rotates with the timing shaft 1304 within an aperture arranged to rotatably receive the timing shaft 1304. In some embodiments, the timing shaft 1304 is secured within a jamb assembly as previously described utilizing one or more of the busing brackets and, in such embodiments, the motor 1306 may also be provided on the same jamb assembly or elsewhere on the vehicle body 12.

An exemplary operation of an apparatus according to one embodiment of this disclosure will now be described with reference to FIG. 4, FIGS. 5A-5C, and FIGS. 6A-6C. When it is desired to move the slide-out room 22 from a first or retracted position as shown in FIG. 1 to a second or extended position as shown in FIG. 2, the actuator (e.g., the motor 424) is started, for example, by means of a switch (not shown), and is caused to turn in one direction. The motor 424 drives the drive shaft 422, which in turn causes the drive sprocket 410 to rotate. The timing belt 428 couples the (lower) drive shaft 422 to the (upper) drive shaft 430, so that they are "timed" and the (upper) drive shaft 430 rotates in unison with the (lower) drive shaft 422; and rotation of the (upper) drive shaft 430 in turn causes the (upper) drive sprocket 412 to rotate therewith. The lower and upper drive sprockets 410,412 are respectively engaged with a drive chain assembly 404,406 that is attached to the slide-out room 22. Accordingly, actuation of the motor 424 causes the drive sprockets 410,412 to rotate and drive the drive chain assemblies 404,406 engaged therewith such that the slide-out room 22 is translated along its path relative to and outward from the vehicle body 12. In an alternate embodiment (not shown), the motor 424 is not provided and the slide-out room 22 is only manually driven. In other embodiments, the vehicle 10 includes the slide-out compartment 30, which is driven either manually or via the motor 424 as detailed herein.

Also described herein are various embodiments of jamb mounted slide-out drive assemblies utilizing cables to extend and retract the slide-out room 22 and which may be mounted along the jambs 20 of the opening 18 in the vehicle 10. FIG. 14 illustrates an exemplary jamb mounted slide-out drive assembly 1400 (hereinafter, the assembly 1400) configured to articulate the slide-out room 22 between a retracted and extended position via a plurality of drive cables 1402, according to one or more embodiments. The assembly 1400 is incorporated into the jambs surrounding the slide-out room 22 and may include various different



configurations for actuating the drive cables 1402. For example, FIGS. 15A-15D illustrate an example of the assembly 1400 configured to actuate the drive cables 1402 via a drive chain 1502, according to one or more embodiments. As described below, the drive cables 1402 are adjustably connected to the drive chain 1502 that is in engagement with and driven by a motor 1504, such that actuation of the motor 1504 rotates the drive chain 1502, which in turn actuates the drive cables 1402. FIGS. 16-18 illustrate an example of the assembly 1400 configured to actuate the drive cables 1402 via a screw drive 1602, according to one or more embodiments. As described below, the screw drive 1602 includes a trunnion or drive nut 1604 and a threaded rod or drive shaft 1606 that is rotatable by a motor 1608. In these examples, the plurality of drive cables 1402 are adjustably connected to the drive nut 1604 that is in threaded engagement with the drive shaft 1606, such that actuation of the motor 1608 rotates the drive shaft 1606, thereby driving (or translating) the drive nut 1604 (linearly along the drive shaft 1606), which in turn actuates the drive cables 1402. FIGS. 19-21 illustrate yet another example of the assembly 1400 configured to actuate the drive cables 1402 via the screw drive 1602, according to one or more alternate embodiments. FIGS. 23-24 illustrate yet another example where the drive cables 1402 are actuated via an alternate screw drive assembly, according to one or more alternate embodiments. FIGS. 25-27 illustrate an example where the drive cables 1402 are actuated via a block and tackle drive assembly, according to one or more alternate embodiments. FIGS. 28-29 illustrate an example where a drive chain (e.g., configured as a continuous loop of chain, as a discontinuous segment or strand of chain, etc.) tensions one of the drive cables 1402 (or one cable end of one of the drive cables 1402) to move the slide-out room 22, such that the slide-out room 22 simultaneously activates the remaining drive cables 1402 to synchronize movement of the slide-out room 22, according to one or more alternate embodiments. As more fully described below, any of these configurations for actuating the drive cables 1402 may be incorporated into the jambs surrounding the slide-out room 22 and, therefore, incorporated into the assembly 1400.

With reference to FIGS. 14-15, each of the drive cables 1402 includes a first end and a second end, where the first ends of the drive cables 1402 may be secured to the slide-out room 22 via a cable mount 1404 and where the second ends of the drive cables may be coupled to the drive chain 1502. The length of the drive cables 1402 may be adjusted and, in the illustrated examples, the second ends of the drive cables 1402 are attached to a threaded rod 1406 to facilitate such adjustment as hereinafter described. Thus, the drive cables 1402 may be configured such that their length is adjusted at their second ends. In some examples, the first ends of the drive cables 1402 are also or instead configured to permit adjustment of the length of the drive cables 1402. For example, the first ends of the drive cables 1402 may include a threaded rod that is adjustable at the cable mount 1404.

In the illustrated examples, the assembly 1400 includes a pair of jamb assemblies 1410 (each, a jamb assembly 1410). For example, the pair of jamb assemblies 1410 may include a right jamb assembly 1410a and a left jamb assembly 1410b that correspond to the right sidewall 36 and the left sidewall 34, respectively, of the slide-out room 22. In other embodiments, the pair of jamb assemblies 1410 may be installed at a top and bottom of the opening 18, such that they correspond with a top side and a bottom side of the slide-out room 22. Where the pair of jamb assemblies 1410 are utilized, they may be similarly configured. In even other embodiments,

just one of the jamb assemblies 1410 is provided on one side of the slide-out room 22, for example, the top jamb assembly 1410, the bottom jamb assembly 1410, the right jamb assembly 1410a, or the left jamb assembly 1410b. In one example, just one of the jamb assemblies 1410 is provided on the bottom side of the slide-out room 22.

Regardless of how the assembly 1400 is configured to actuate the drive cables 1402, it may be mounted within the opening 18 in the vehicle body 12 and, in particular, at the jambs 20 arranged about the opening 18. In the illustrated examples, each of the jamb assemblies 1410 includes a jamb member or frame member 1420 configured to secure the jamb assembly 1410 to the vehicle 20 (e.g., to the sidewall 16 thereof). In addition, the frame member 1420 is configured as a shroud to house the various drive components of the jamb assembly 1410 and thereby protect such drive components. Thus, the frame member 1420 may secure the jamb assembly 1410 and its various internal drive components (detailed below) to the vertical and/or horizontal edges of the opening 18. Here, the frame members 1420 secure the jamb assemblies 1410 to the vertical edges of the opening 18. The jamb assemblies 1410 may also include one or more additional jamb members or frame members such that the assembly 1400 defines a frame about the slide-out room 22. Here, for example, jamb assemblies 1410 also includes a bottom frame member 1422 and a top frame member 1424, such that the frame members 1420 (i.e., of the left and right jamb assemblies 1410a, 1410b), the bottom frame member 1422, and the top frame member 1424 together define a square shaped frame surrounding the slide-out room 22. Also, any or all of the frame members 1420, the bottom frame member 1422, and the top frame member 1424 may be configured to form a seal with the slide-out room 22 to inhibit ingress of debris to within the vehicle 10. In addition, as described below, any or all of the frame members 1420, the bottom frame member 1422, and the top frame member 1424 may be configured to guide or track the slide-out room 22 evenly within the opening 18 in the vehicle 10 and/or be configured to cover or house timing mechanisms that synchronize operation of the jamb assemblies 1410a, 1410b. For example, any or all of the frame members 1420, the bottom frame member 1422, and the top frame member 1424 may include a tracking roller assembly as described with reference to FIG. 22.

Each of the jamb assemblies 1410 may include a motor or actuator, as described below. In some embodiments, just one of the jamb assemblies 1410 includes a motor. The motors may be arranged within the frame member 1420 or exterior of the frame. The frame member 1420 may have various configuration and, in the illustrated examples, the frame member 1420 is an extruded member having a web portion and a pair of opposing sidewalls (or flanges) in the form of a "C" beam.

Regardless of how many motors are utilized and where they are arranged, however, the jamb assemblies 1410 may be "timed" or synchronized such that they operate in unison. Where each of the jamb assemblies 1410 includes a separate motor/actuator, the motors/actuators may be electronically timed via sensors and/or feedback. The jamb assemblies 1410 may also be mechanically "timed" or synchronized via a timing mechanism such as a timing shaft or cross bar 1412. For example, where each of the jamb assemblies 1410 includes a separate motor/actuator, a mechanical timing mechanism 1430 may be utilized to ensure that the jamb assemblies 1410 operate in unison. Also, where just one of the jamb assemblies 1410 includes a motor, the mechanical timing mechanism 1430 may be utilized to transfer power to



the jamb assembly 1410 without the motor. In some examples, each of the jamb assemblies 1410 includes a separate motor/actuator and the separate motors/actuators are both electronically timed and mechanically timed (e.g., the mechanical timing mechanism 1430).

In the illustrated example, the mechanical timing mechanism 1430 includes a timing shaft 1432; however, other timing mechanisms may be utilized in addition to or in lieu thereof, such as a timing belt. Here, the timing shaft 1432 is shrouded by the bottom frame member 1422 and is supported therein via a support 1434. Thus, in the illustrated example, timing mechanism 1430 is configured within the bottom frame member 1422; however, the bottom frame member 1422 and/or the support 1434 are optional. In other examples, the timing shaft 1432 may instead be arranged within the top frame member 1424. In even other examples, both the bottom frame member 1422 and the top frame member 1424 include the timing mechanism 1430.

FIGS. 15A-15D illustrate one of the jamb assemblies 1410 configured to actuate the drive cables 1402 via the drive chain 1502, according to one or more embodiments. FIG. 15A is a side view of the jamb assembly 1410 configured with the drive chain 1502. FIG. 15B illustrates a close up of a top end of the jamb assembly 1410 of FIG. 15A. FIG. 15C illustrates a close up of a bottom end of the jamb assembly 1400 of FIG. 15A. FIG. 15D illustrates a close up of a middle portion of the jamb assembly 1410 of FIG. 15A.

In the exemplary embodiment of FIGS. 15A-15D, the drive chain 1502, the motor 1504, and other drive components of the jamb assembly 1400 are arranged within the frame member 1420. The frame member 1420, however, is not illustrated in these figures to facilitate illustration of the drive chain 1502, the motor 1504, and the other drive components arranged therein. In these illustrated examples, the jamb assembly 1410 further includes a drive sprocket 1506 and an idler sprocket 1508 that are configured to receive the drive chain 1502. The motor 1504 is coupled to the drive sprocket 1506 such that the motor 1504 may impart rotation to the drive sprocket 1506. In addition, the drive sprocket 1506 and the idler sprocket 1508 each include teeth that mesh with the drive chain 1502. Thus, rotation of the drive sprocket 1506 causes the drive chain 1502 to travel along a predefined path according to the geometry and placement of the drive sprocket 1506 and the idler sprocket 1508. The drive sprocket 1506 and idler sprocket 1508 may be secured at various locations within the frame member 1420 and, in the illustrated embodiment, the drive sprocket 1506 is secured at a top end of the frame member 1420 and the idler sprocket 1508 is secured at a bottom end of the frame member 1420. Similarly, the motor 504 may be arranged within the frame member 1420.

The drive sprocket 1506 is configured to be rotated, and thereby drive the drive chain 1502. Torque may be imparted to the drive sprocket 1506 via any number of manners. For example, the drive sprocket 1506 may be manually rotated or coupled to an electronically controlled actuator such as the motor 1504 that is configured to impart torque to the drive sprocket 1506. Accordingly, the motor 1504 may be actuated to rotate the drive chain 1502 in a first or second direction about the drive sprocket 1506 and the idler sprocket 1508.

The idler sprocket 1508 may be configured with a timing shaft to synchronize operation of the pair of jamb assemblies 1410. In the illustrated example, the idler sprocket 1508 is coupled to the timing shaft 1432 configured to synchronize the right and left jamb assemblies 1410a,1410b. Not only does the timing shaft 1432 time or synchronize operation of

the jamb assemblies 1410, but it facilitates manually overriding one of the jamb assemblies 1410, as an individual one of the jamb assemblies 1410 (e.g., the right jamb assembly 1410a) may be manually manipulated and that action will be communicated to the other one of the jamb assemblies 1410 (e.g., the left jamb assembly 1410b) via the timing shaft 1432. In the illustrated embodiment, the timing shaft 1432 couples the idler sprocket 1508 of the right jamb assembly 1410a to the idler sprocket 1508 of the left jamb assembly 1410b. Accordingly, the motor 1504 in each of the jamb assemblies 1410 will be timed or synchronized. In other embodiments, the motor 1504 may be provided in only one of the jamb assemblies 1410 and, in these other embodiments, the timing shaft 1432 operates as a drive member for the jamb assembly 1410 without the motor 1504 by transferring torque thereto.

The jamb assemblies 1410 may also be configured with a plurality of guides or pulleys for routing the drive cables 1402 as hereinafter described. In the illustrated embodiment, a top and bottom cable guide 1510,1512 are provided and secured at top and bottom ends of the frame member 1420, respectively. Here, the top and bottom cable guides 1510, 1512 are configured as double pulleys such that they each may receive a pair of the drive cables 1402 without interfering with each other or causing rubbing or friction between the drive cables 1402. The top and bottom cable guides 1510,1512 may be configured as double pulleys. This means, for example, that the top cable guide 1510 includes a pair of independent pulleys that may rotate relative to each other, or include independent cable tracks, so as to permit a pair of drive cables 1402 to travel therein in opposing direction without interference; and the bottom cable guide 1512 may be similarly configured. Also in this embodiment, a cable idler 1514 is provided proximate to the bottom cable guide 1512 for redirecting the path of any of the drive cables 1402 as hereinafter described; and, where utilized, the cable idler may also be configured as a double pulley, such that it may guide a pair of the drive cables 1402 without interference, rubbing, or friction between the drive cables 1402.

In the illustrated embodiment, the drive chain 1502 is coupled to the drive cables 1402 and, as the drive chain 1502 is rotated in a first direction D1 or a second direction D2 about the drive sprocket 1506 and the idler sprocket 1508, the drive chain 1502 pulls the drive cables 1402 to extend or retract the slide-out room 22.

After extended use of the assembly 1400, the drive cables 1402 may become stretched from their original lengths, and the different drive cables 1402 may be stretched different amounts such that they have different overall lengths, thereby causing misalignment that may inhibit the slide-out room 22 from being fully retracted. For example, the bottom set of drive cables 1402 may be subject to the greatest load of all of the drive cables 1402 and, therefore, the working length thereof may stretch out or expand to a greater degree than the other cables, and this may result in the assembly 1400 becoming misaligned. Thus, the drive cables 1402 may need to be adjusted periodically to ensure that they are of the optimal working length. In the illustrated examples, the drive cables 1402 are adjustably coupled to drive chain 1502 via a pair of cable chain connectors 1520 (hereinafter, individually referred to as the "connector 1520"). The connector 1520 is configured to couple the drive chain 1502 to one or more drive cables 1402 such that the drive cables 1402 extend or retract from the jamb assembly 1410 as the drive chain 1502 rotates.

FIG. 15D illustrates a close-up view of a first connector and a second connector 1520a,1520, according to one or



more embodiments. The first and second connectors **1520a**, **1520b** may be identically configured or be differently configured with respect to each other. In particular, a first pair of the cables **1402** are adjustably connected to the drive chain **1502** via the first connector **1520a** and a second pair of the drive cables **1402** are adjustably connected to the drive chain **1502** via the second connector **1520b**. Thus, two connectors **1520** (i.e., the first and second connectors **1520a**, **1520b**) may be utilized to couple the four (4) drive cables **1402** to the drive chain **1502**. However, a single connector **1520** may be utilized to connect the four (4) drive cables **1402** to the drive chain **1502** if two (2) of the drive cables **1402** are re-routed over pulleys or guides.

The connector **1520** is configured to secure to the drive chain **1502** and to secure to an end of the cable **1402** (i.e., the end that is not secured to the slide-out room **22**), such connector **1520** interconnects the drive cables **1402** and the drive chain **1502**. In this manner, the cable **1402** is coupled to the drive chain **1502** such that the cable **1402** will move with the drive chain **1502**. Also, the connector **1520** is configured to be attached to the drive chain **1502** regardless of whether the drive chain **1502** is provided as a closed loop (without any free ends), or whether the drive chain **1502** is open with first and second loose ends, or whether the drive chain **1502** is formed from a pair of open chains that each include a pair of loose ends. Thus, the drive chain **1502** defines an endless loop during operation regardless of how it is provided.

The connectors **1520** are configured to permit adjustment of the drive cables **1402** and the drive chain **1502**. The connector **1520** is configured to permit adjustment of the drive cables **1402**, such that the working length of the drive cables **1402** may be lengthened or shortened as needed in a particular application. As used herein, the term “working length” of a particular one of the drive cables **1402** means the length of the drive cable extending between the cable mount **1404** and the connector **1520**. In the illustrated example, the connectors **1520** each include an adjustment nut **1522** that receives the threaded rod **1406** of the drive cables **1402**. Here, the adjustment nut **1522** may be rotated to move the threaded rod **1406** extending there-through, forward or backward, which in turn will add tension or remove tension from the drive cable **1402** associated therewith. Thus, the working length of the drive cables **1402** may be adjusted by rotating the adjustment nut **1522**.

As mentioned, the connector **1520** may also be configured to permit adjustment of the chain **1502**. In the illustrated example, the drive chain **1502** is comprised of a first and second chain length **1524,1526** that each include a first and second loose end. Thus, the first chain length **1524** includes a pair of loose ends **1524a,1524b** and the second chain length **1526** includes a pair of loose ends **1526a,1526b**. Here, each of the connectors **1520,1520b** has a first and second chain mounting end **1528a,1528b**, such that the loose ends **1524a,1524b** of the first chain length **1524** are secured to the first mounting end **1528a** of the first connector **1520a** and the second mounting end **1528b** of the second connector **1520b**, respectively, and such that the loose ends **1526a,1526b** of the second chain length **1526** are secured to the first mounting end **1528a** of the second connector **1520b** and the second mounting end **1528b** of the first connector **1520a**, respectively. The drive chain **1502** may be secured to the connector **1520** via a variety of manners and, in the illustrated example, the loose ends **1524a,1524b,1526a,1526b** of the first and second chain lengths **1524,1526** are pinned to the first and second mounting ends **1528a,1528b**, respectively. Either or both of the connectors **1520a,1520b** may be

configured to permit adjustment to the chain lengths **1524,1526**. In the illustrated example, the second mounting end **1528b** of the second connector **1520b** includes a chain adjustment portion **1530**. Here, the chain adjustment portion **1530** includes a threaded rod **1532** and an adjustment nut **1534**, where rotation of the adjustment nut **1534** will extend or retract the threaded rod **1532**, thereby effectively increasing the length of the chain length **1524** and, thus, the overall length of the drive chain **1502**. The chain adjustment portion **1530** may instead be provided on the first mounting end **1528a**, or provided on both the first and second mounting ends **1528a,1528b**; also, the first and/or second mounting ends **1528a,1528b** of the first connector **1520a** may similarly be configured with the chain adjustment portion. Thus, just one of the connectors **1520** may have the chain adjustment portion **1530**, or both of the connectors **1520a,1520b** may have at least one chain adjustment portion **1530**.

As previously mentioned, the drive cables each include a first end where they are attached to an anchor mount **1404** and a second at which they are attached to the connector **1520**. Thus, the drive cables **1402** are coupled to the slide-out room **22** at their first ends and coupled to the vehicle **10** body at their second ends. In the illustrated embodiment, the anchor **1404** is a bracket that is mounted to the sidewall of the slide-out room **22**. However, the drive cables **1502** may be differently secured to the slide-out room **22** via other anchoring means.

In the illustrated embodiments, eight (8) of the drive cables **1402** are utilized, where four (4) of the drive cables **1402** may be utilized for pulling the slide-out room **22** out of the vehicle **10** (i.e., connected proximate to the rear frame **408** of the slide-out room **22**) and where the other four (4) drive cables **1402** may be utilized for pulling the slide-out room **22** into the vehicle **10** (i.e., connected proximate to the outside wall **38** of the slide-out room **22**). Accordingly, four (4) of the drive cables **1402** may be arranged on each of the opposing left and right sidewalls **34,36** of the slide-out room **22**, with each of the drive cables **1402** being secured at one of its first end to a corner of the slide-out room **22**. Each of the drive cables **1402** then extends into its associated jamb or frame member **1420**, wraps around a guide member(s) or pulley(s) arranged within the frame member **1420**, and connects (at its second end) to the drive chain **1502** via the connector **1520**. Thus, for example, when the drive chain **1502** rotates in the first direction **D1**, it pulls the four (4) drive cables **1402** attached at the upper and lower corners of the sidewalls that are proximate to the front wall **14** of the slide-out room **22**, and simultaneously gives slack in the other four (4) drive cables **1402** attached at the upper and lower corners of the sidewalls that are proximate to the rear wall of the slide-out room **22**. For example, rotation of the drive chain **1502** in the first direction **D1** pulls a front upper and front lower drive cable **1542a,b** in a direction **X1**, while simultaneously providing slack to a rear upper and rear lower drive cable **1542c,d** to facilitate retraction of the slide-out room **22**; whereas, rotation of the drive chain **1502** in the second direction **D2** pulls a rear upper and rear lower drive cable **1542c,d** in a direction **X2**, while simultaneously providing slack to the front upper and front lower drive cable **1542a,b** to facilitate extension of the slide-out room **22** from the vehicle **10**.

In the illustrated embodiment, the drive chain **1502** is connected to a pair of the connectors **1520**, and each of the connectors **1520** is secured to two (2) of the drive cables **1402**. Also, the cables **1402** extend from opposite sides of the connector **1520** such that, as the drive chain **1502** rotates in the first direction **D1**, some of the cables **1402** (i.e., the



rear upper and rear lower drive cables **1542c,d**) will give slack in direction **X1** and the other drive cables **1402** (i.e., the front upper and front lower drive cables **1542a,b**) will be pulled in that direction **X1**.

In the illustrated example of FIGS. **15A-15D**, the first connector **1520a** is coupled to the rear upper drive cable **1542c** and the front lower drive cable **1542b**, where the rear upper drive cable **1542c** is secured to an upper rear side of the slide-out room **22** and the front lower drive cable **1542b** is secured to a lower front side of the slide-out room **22**. Similarly, the second connector **1520b** is coupled to the front upper drive cable **1542a** and the rear lower drive cable **1542d**, where the front upper cable **1542a** is secured to an upper front side of the slide-out room **22** and the rear lower drive cable **1542d** is secured to a lower rear side of the slide-out room **22**. The front upper drive cable **1542a** extends upward from the second connector **1520b** towards the upper end of the frame member **1420**, up and around a first cable track of the top cable guide **1510**, and out a front upper opening in the frame member **1420** towards the front of the slide-out room **22**. The rear lower drive cable **1542d** extends downward from the second connector **1520b**, along a first cable track of the cable idler **1514** (thereby redirecting the rear lower drive cable **1542d**), down and around a first cable track of the bottom cable guide **1512**, and out a rear lower opening in the frame member **1420** towards the rear of the slide-out room **22**. The front lower drive cable **1542b** extends downward from the first connector **1520a**, along a second cable track of the cable idler **1514** (thereby redirecting the front lower drive cable **1542b**), down and around a second cable track of the bottom cable guide **1512**, and out a front lower opening in the frame member **1420** towards the front of the slide-out room **22**. Finally, the rear upper drive cable **1542c** extends upward from the first adjuster **1520a** toward the upper end of the frame member **1420**, up and around a second cable track of the top cable guide **1510**, and out a rear upper opening in the frame member **1420** towards the rear of the slide-out room **22**.

Accordingly, when the drive chain **1502** rotates in the first direction **D1**, the drive chain **1502** pulls the front upper drive cable **1542a** and the front lower drive cable **1542b** and pushes or slackens (i.e., provides slack in) the rear upper drive cable **1542c** and the rear lower drive cable **1542d**. In this manner, the front side of the slide-out room **22** may be pulled towards the opening **18** in the vehicle **10** via the front upper and lower drive cables **1542a,1542b** such that the slide-out room **22** is retracted within the vehicle **10**. When the drive chain **1502** rotates in the second direction **D2**, the drive chain **1502** pulls the rear upper drive cable **1542c** and the rear lower drive cable **1542d**, while pushing or slackening (i.e., providing slack in) the front upper and lower drive cables **1542a,1542b**. In this manner, the rear side of the slide-out room **22** may be pulled towards the opening **18** in the vehicle **10** via the rear upper drive cable **1542c** and the rear lower drive cable **1542d** such that the slide-out room **22** is extended from within the vehicle **10**.

In these embodiments, the motor **1504** may be arranged in each of the jamb assemblies **1410a,1410b** to drive one of the sprockets (e.g., the drive sprocket **1506** or the idler sprocket **1508**) therein and engage the other sprocket therein (e.g., the idler sprocket **1508** or the drive sprocket **1506**) via the drive chain **1502** configured as an endless chain that is also arranged therein; and in such embodiments, the motors **1504** in the opposing jamb assembly **1410** may be synchronized or timed, for example, via a Hall effect sensor. In even other embodiments, the slide-out drive assembly includes a timing shaft or belt that synchronizes the rotation of the drive

sprockets that are arranged in the opposing jambs. In some of these embodiments, a single motor may be provided within one of the jambs (i.e., the drive side jamb) to power the drive sprocket in the drive side jamb as well as the timing shaft or belt, and the timing shaft or belt in turn drives the drive sprocket arranged in the opposing jamb (i.e., the slave side jamb) such that the drive sprockets in the drive side jamb and the slave side jamb are synchronized, as will be appreciated by those skilled in the art. In even other embodiments, both the drive side jamb and the slave side jamb include a motor and their respective drive sprockets (and/or idler sprockets) are synchronized with a timing shaft or belt, as will be appreciated by those skilled in the art.

As mentioned, the assembly **1400** may include the screw drive **1602** that is configured to actuate the drive cables **1402**. FIGS. **16-18** illustrate an example of the jamb assembly **1410** configured with the screw drive **1602** according to one or more embodiments, whereas FIGS. **19-21** and FIGS. **23-24** illustrate alternate examples of screw drives utilizable with the jamb assembly **1410**, according to various alternate embodiments. In these examples, the screw drive **1602** may be arranged within the frame member or jamb member **1420**. Here, the motor **1608** is arranged within an upper end of the frame member **1420** and the drive shaft **1606** extends, vertically along an axis **A** of the drive shaft **1606**, from the upper end of the frame member **1420** towards a lower end of the frame member **1420**. The drive shaft **1606** is coupled to the motor **1608**, such that actuation of the motor **1608** rotates the drive shaft **1606** in a first or second rotational direction **R1,R2** about the axis **A**. The drive shaft **1606** may be configured as a threaded rod. Also, the drive nut **1604** includes a bore through which the drive shaft **1606** extends. The bore of the drive nut **1604** is configured to engage the drive shaft **1606**, such that rotation of the drive shaft in the first rotational direction **R1** causes the drive nut **1604** to translate along the axis **A** of the drive shaft **1606** in a first axial direction **Y1**, and rotation of the drive shaft **1606** in the second rotational direction **R2** (that is opposite the first rotational direction **R1**) causes the drive nut **1604** to translate along the axis **A** of the drive shaft **1606** in a second axial direction **Y2** (that is opposite of the first axial direction **Y1**). The manner in which the screw drive **1602** translates rotation of the drive shaft **1606** into linear movement of the drive nut **1604** may vary. For example, the screw drive **1602** may be configured as an acme screw, a ball screw, etc.

In these examples, the jamb assemblies **1410** may also be configured with a plurality of guides or pulleys for routing the drive cables **1402** as hereinafter described. In the illustrated example of FIGS. **16-18**, a top and bottom cable guide **1610,1612** are provided and secured at top and bottom ends of the frame member **1420**, respectively. The top and bottom cable guides **1610,1612** may be configured as double pulleys such that they each may receive a pair of the drive cables **1402** without interfering with each other or causing rubbing or friction between the drive cables **1402**. This means, for example, that the top cable guide **1610** includes a pair of independent pulleys that may rotate relative to each other, or include independent cable tracks, so as to permit a pair of the drive cables **1402** to travel therein in opposing direction without interference; and the bottom cable guide **1612** may be similarly configured. Here, the top and bottom cable guides **1610,1612** are configured as double pulleys; however, in other examples, a pair of top cable guides and a pair of bottom cable guides may be utilized instead, as described below. Also in the illustrated example, an upper cable idler **1614** is arranged proximate to the top cable guide **1610** and a lower cable idler **1616** is arranged proximate to the bottom



cable guide 1612. As hereinafter described, the upper and lower cable idlers 1614,1616 are configured to redirect the path of any of the drive cables 1402; and, where utilized, the cable idler may also be configured as a double pulley, such that it may redirect and guide a pair of the drive cables 1402, without interference, rubbing, or friction between the drive cables 1402. In the illustrated example, the upper and lower cable idlers 1614,1616 are attached to the web portion of the frame member 1420; however, they may be differently arranged within the frame member 1420, for example, on the same sidewall thereof, on opposing sidewalls, on the web portion and a sidewall, etc.

The internal components of the jamb assembly 1410 configured with the screw drive 1602 may be coupled or fastened within the frame member 1420 via a variety of manners. In some examples, the motor 1608 is mounted within the frame member 1420 via a collar 1620, and, in some of these examples, the collar 1620 may include one or more dampeners and/or be otherwise configured to inhibit or counteract vibrations from the motor 1608. The motor 1608 may be differently arranged within the frame member 1420. Also, a far end of the shaft 1606 (i.e., the end of the shaft 1606 that is opposite from an opposing end of the shaft 1606 at which the motor 1608 is mounted) may be mounted to the frame member 1420 via a variety of manners. In the illustrated example, the far end of the shaft 1606 is coupled within the frame member 1420 via a bracket 1622. Here, a bearing or bearing assembly 1624 is arranged within the bracket 1622 such that the shaft 1606 may rotate when secured within the bracket 1622.

FIG. 18A illustrates the path of the drive cables 1402 utilized in the example of FIGS. 16-17, and FIG. 18B illustrates an example of the drive nut 1604 configured to actuate the drive cables along the path of FIG. 18A. The drive cables 1402 include a front upper drive cable 1642a (which is secured to a front upper side of the slide-out room 22), a front lower drive cable 1642b (which is secured to a front upper side of the slide-out room 22), a rear upper drive cable 1642c (which is secured to a rear upper side of the slide-out room 22), and a rear lower drive cable 1642d (which is secured to a rear lower side of the slide-out room 22). In the illustrated example, the front upper drive cable 1642a and the front lower drive cable 1642b extend from an upper side of the drive nut 1604, and the rear upper drive cable 1642c and the rear lower drive cable 1642d extend from a lower side of the drive nut 1604. In this manner, the front upper drive cable 1642a and the front lower drive cable 1642b are actuated together and the rear upper drive cable 1642c and the rear lower drive cable 1642d are actuated together opposite from the front upper drive cable 1642a and the front lower drive cable 1642b. More particularly, movement of the drive nut 1602 in the first axial direction Y1 pushes the front upper drive cable 1642a and the front lower drive cable 1642b out of the frame member 1420 (i.e., provides slack), while pulling the rear upper drive cable 1642c and the rear lower drive cable 1642d into the frame member 1420; whereas movement of the drive nut 1602 in the second axial direction Y2 pulls the front upper drive cable 1642a and the front lower drive cable 1642b into the frame member 1420, while pushing (i.e., slackening) the rear upper drive cable 1642c and the rear lower drive cable 1642d out from the frame member 1420.

Also in the illustrated example, the front upper drive cable 1642a, the front lower drive cable 1642b, the rear upper drive cable 1642c, and the rear lower drive cable 1642d are each an adjustably secured drive nut 1604. Thus, they may be unattached from the drive nut 1604, pulled tight, and

reattached to the drive nut 1604 as needed to adjust their lengths. Also, the drive nut 1604 may be configured to guide any of the drive cables 1402 such that the cables 1402 are organized within the frame member 1410 and do not become tangled. Here, for example, the drive nut 1604 includes a pair of guide slots formed therein. In particular, the first such guide slot is formed within the drive nut 1604 for receiving the front lower drive cable 1642b (after being re-routed over the upper idler 1614) and organizes the front lower drive cable 1642b between the front upper drive cable 1642a and the rear upper drive cable 1642c; and, the second such guide slot is formed within the drive nut 1604 for receiving the rear upper drive cable 1642c (after being re-routed over the lower idler 1616) and organizes the rear upper drive cable 1642c between the front lower drive cable 1642b and the rear lower drive cable 1642d. However, the drive nut 1604 may be differently configured to organize any or all of the drive cables 1402.

As illustrated, the front upper drive cable 1642a extends upward from the upper side of the drive nut 1604, towards the upper end of the frame member 1420, up and around a first cable track of the top cable guide 1610, and out a front upper opening in the frame member 1420 towards the front upper corner of the slide-out room 22. The front lower drive cable 1642b extends upward from the upper side of the drive nut 1604, around and along a cable track of the upper cable idler 1614 (thereby redirecting the front lower drive cable 1642b downward within the frame member 1420 and through the guide slot formed in the drive nut 1604), down and around a first cable track of the bottom cable guide 1612, and out a front lower opening in the frame member 1420 towards the front lower corner of the slide-out room 22. The rear upper drive cable 1642c extends downward from the bottom side of the drive nut 1604, around and along a cable track of the lower cable idler 1616 (thereby redirecting the rear upper drive cable 1642c upward within the frame member 1420 and through the guide slot formed in the drive nut 1604), up and around a second cable track of the top cable guide 1610, and out a rear upper opening in the frame member 1420 towards the rear upper corner of the slide-out room 22. Finally, the rear lower drive cable 1642d extends downward from the bottom side of the drive nut 1604, toward the lower end of the frame member 1420, down and around a second cable track of the bottom cable guide 1612, and out a rear lower opening in the frame member 1420 towards the lower rear corner of the slide-out room 22.

Accordingly, upon rotation of the drive shaft 1606 in the first rotational direction R1, thereby translating the drive nut 1604 linearly along the axis A in the first axial direction Y1, the drive nut 1604 pulls the rear upper drive cable 1642c and the rear lower drive cable 1642d and pushes or slackens the front upper drive cable 1542a and the front lower drive cable 1542c. In this manner, the rear side of the slide-out room 22 may be pulled towards the opening 18 in the vehicle 10 via the rear upper and lower drive cables 1642c,1642d such that the slide-out room 22 is extended from the vehicle 10. When the drive shaft 1606 rotates in the second rotational direction R2, the drive nut 1604 pulls the front upper drive cable 1542a and the front lower drive cable 1542b, while pushing or slackening (i.e., providing slack in) the rear upper and lower drive cables 1542c,1542d. In this manner, the front side of the slide-out room 22 may be pulled towards the opening 18 in the vehicle 10 via the front upper drive cable 1542a and the front lower drive cable 1542b, such that the slide-out room 22 is retracted within the vehicle 10.

FIGS. 19-21 illustrate example of the jamb assembly 1410 configured with the screw drive 1602 having a different



configuration of guide members and pulleys such that the drive cables **1402** are differently routed. Here, the jamb assembly **1410** includes a pair of top cable guides **1910a**, **1910b** and a pair of bottom cable guides **1912a**, **1912b**. In the illustrated example, the top and bottom cable guides **1910a**, **1910b**, **1912a**, **1912b** are each configured as single pulleys, and each include a single cable track for accommodating one of the drive cables **1402**; however, in other examples, any or all of the top and bottom cable guides **1910a**, **1910b**, **1912a**, **1912b** may be configured with more than one cable track for accommodating more than one of the drive cables **1402** and, in such examples, may further be configured as a double pulley that permits independent actuation of the drive cables **1402**. Also in the illustrated example, an upper cable idler **1914** is arranged proximate to the top cable guides **1910a**, **1910b** and a lower cable idler **1916** is arranged proximate to the bottom cable guides **1912a**, **1912b**. As hereinafter described, the upper and lower cable idlers **1914**, **1916** are configured to redirect the path of any of the drive cables **1402**; and, where utilized, the cable idlers **1914**, **1916** may also be configured as a double pulley, such that it may redirect and guide a pair of the drive cables **1402**, without interference, rubbing, or friction between the drive cables **1402**. In the illustrated example, the upper and lower cable idlers **1914**, **1916** are attached to opposing sidewalls of the frame member **1420** (i.e., the upper cable idler **1914** is attached to a first sidewall and the lower cable idler **1916** is attached to a second sidewall opposite to the first sidewall); however, they may be differently arranged within the frame member **1420**, for example, on the same sidewall thereof, on the web portion thereof, on the web portion and a sidewall, etc.

FIG. 21A illustrates the path of the drive cables **1402** utilized in the example of FIGS. 19-20, and FIG. 21B illustrates an example of the drive nut **1604** configured to actuate the drive cables along the path of FIG. 21A. The drive cables **1402** include a front upper drive cable **1942a** (which is secured to a front upper side of the slide-out room **22**), a front lower drive cable **1942b** (which is secured to a front upper side of the slide-out room **22**), a rear upper drive cable **1942c** (which is secured to a rear upper side of the slide-out room **22**), and a rear lower drive cable **1942d** (which is secured to a rear lower side of the slide-out room **22**). In the illustrated example, the front upper drive cable **1942a** and the front lower drive cable **1942b** extend from the lower side of the drive nut **1604**, and the rear upper drive cable **1942c** and the rear lower drive cable **1942d** extend from the upper side of the drive nut **1604**. In this manner, the front upper drive cable **1942a** and the front lower drive cable **1942b** are actuated together and the rear upper drive cable **1942c** and the rear lower drive cable **1942d** are actuated together. More particularly, movement of the drive nut **1602** in the second axial direction **Y2** pushes the front upper drive cable **1942a** and the front lower drive cable **1942b** out of the frame member **1420** (i.e., provides slack), while pulling the rear upper drive cable **1942c** and the rear lower drive cable **1942d** into the frame member **1420**; whereas movement of the drive nut **1602** in the first axial direction **Y1** pulls the front upper drive cable **1942a** and the front lower drive cable **1942b** into the frame member **1420**, while pushing (i.e., slackening) the rear upper drive cable **1942c** and the rear lower drive cable **1942d** out from the frame member **1420**.

As with the drive nut **1604** in the examples illustrated with respect to FIGS. 16-18, the front upper drive cable **1942a**, the front lower drive cable **1942b**, the rear upper drive cable **1942c**, and the rear lower drive cable **1942d** may each be an adjustably secured drive nut **1604**. Thus, they may be

unattached from the drive nut **1604**, pulled tight, and reattached to the drive nut **1604** as needed to adjust their lengths. Also, the drive nut **1604** may be configured to organize any or all of the drive cables **1942a**, **1942b**, **1942c**, **1942d** within the frame member **1410** so that they do not become tangled. Here, for example, the drive nut **1604** includes a pair of guide slots formed therein, where a first such guide slot receives the front upper drive cable **1942a** (after being re-routed over the lower idler **1916**) and organizes it at a first corner of the drive nut **1604**, and a second such guide slot receives the rear lower drive cable **1942d** (after being re-routed over the upper idler **1914**) and organizes it at a second corner of the drive nut **1604**. However, the drive nut **1604** may be differently configured to organize any or all of the drive cables **1402**.

As illustrated, the front upper drive cable **1942a** extends downward from the lower side of the drive nut **1604**, towards the lower end of the frame member **1420**, around and along a cable track of the lower cable idler **1916** (thereby redirecting the front upper drive cable **1942a** upward within the frame member **1420** and through the guide slot formed in the drive nut **1604**), up and around the (first) top cable guide **1910a**, and out a front upper opening in the frame member **1420** towards the front upper corner of the slide-out room **22**. The front lower drive cable **1942b** extends downward from the lower side of the drive nut **1604**, down and around the (first) bottom cable guide **1912a**, and out a front lower opening in the frame member **1420** towards the front lower corner of the slide-out room **22**. The rear upper drive cable **1942c** extends upward from the upper side of the drive nut **1604**, up and around the (second) top cable guide **1910b**, and out a rear upper opening in the frame member **1420** towards the rear upper corner of the slide-out room **22**. Finally, the rear lower drive cable **1942d** extends upward from the upper side of the drive nut **1604**, around the upper cable idler **1914** (thereby redirecting the rear lower drive cable **1942d** downward within the frame member **1420** and through the guide slot formed in the drive nut **1604**), toward the lower end of the frame member **1420**, down and around a track of the (second) bottom cable guide **1912b**, and out a rear lower opening in the frame member **1420** towards the lower rear corner of the slide-out room **22**.

Accordingly, upon rotation of the drive shaft **1606** in the second rotational direction **R2**, thereby translating the drive nut **1604** linearly along the axis **A** in the second axial direction **Y2**, the drive nut **1604** pulls the rear upper drive cable **1942c** and the rear lower drive cable **1942d** and pushes or slackens the front upper drive cable **1942a** and the front lower drive cable **1942b**. In this manner, the rear side of the slide-out room **22** may be pulled towards the opening **18** in the vehicle **10** via the rear upper and lower drive cables **1942c**, **1942d** such that the slide-out room **22** is extended from the vehicle **10**. When the drive shaft **1606** rotates in the first rotational direction **R1**, thereby translating the drive nut **1604** in the first axial direction **Y1**, the drive nut **1604** pulls the front upper drive cable **1942a** and the front lower drive cable **1942b**, while pushing or slackening (i.e., providing slack in) the rear upper and lower drive cables **1942c**, **1942d**. In this manner, the front side of the slide-out room **22** may be pulled towards the opening **18** in the vehicle **10** via the front upper drive cable **1942a** and the front lower drive cable **1942b**, such that the slide-out room **22** is retracted within the vehicle **10**.

FIG. 22 illustrates an exemplary tracking roller assembly **2200**, according to one or more examples. For example, the tracking roller assembly **2200** may be utilized with any of the cable driven slide-out assemblies described herein,



including but not limited to those illustrated with respect to FIGS. 14-21 of FIGS. 23-29. The tracking roller assembly 2200 may be utilized to evenly guide the slide-out room 20 and maintain it in a centered position within the opening 18 of the vehicle 10. In the illustrated example, tracking roller assembly 2200 includes a roller 2202 and a mounting bracket 2204 having a pair of flanges 2206,2208 for holding the roller 2202. The roller 2202 is arranged between the flanges 2206,2208 such that the roller 2202 may rotate relative to the mounting bracket 2204. Thus, the roller 2202 is rotatably mounted to or rotatably arranged within the mounting bracket 2204. The tracking roller assembly 2200 may be attached to an outer surface of the frame member 1420 that is proximate to the slide-out unit 22. Here, for example, the mounting bracket 2204 is secured to an outer surface of the web of the frame member 1420. Also, the tracking roller assembly 2200 may be provided at an upper end of each jamb assembly 1410, a lower end of each jamb assembly 1410, a middle of each jamb assembly 1410, or any combination thereof. Here, for example, each of the left and right jamb assemblies 1410a,1410b includes a tracking roller assembly 2200 at the upper and lower ends of the frame member 1420. In some examples, bearings are provided within the roller 2202 to engage a shaft (not illustrated) connected between the flanges 2206,2208; whereas, in other examples, the roller 2202 includes an integral shaft that is rotatably attached within apertures in the flanges 2206,2208 and a bearing may be provided within the apertures of the flanges 2206,2208.

FIG. 23 illustrates an alternate screw drive assembly 2300 configured to actuate the drive cables to move the slide-out room 22 relative to the vehicle 10. The screw drive assembly 2300 may be provided in a jamb assembly and secured to the vehicle 10 as previously described. For example, the screw drive assembly 2300 may be provided in the left and right jamb assembly 1410a,1410b which are secured within the opening 18 in the vehicle 10.

In the illustrated example, the screw drive assembly 2300 includes a drive nut 2302 that translates axially along a drive rod 2304 upon rotation of the drive rod 2304. Here, a plurality of drive cables 2306 are connected to the drive nut 2302 such that they move with the drive nut 2302 as it translates along the drive rod 2304. The drive cables 2306 are routed, from the drive nut 2302, about one or more pulleys. In particular, the screw drive assembly 2300 includes a pair of double pulleys 2308, 2310 and a pair of guide members 2312,2314. The double pulleys 2308,2310 are configured to allow movement of a pair of the drive cables 2306, independently from each other, whereas the guide members 2312,2314 are configured as single pulleys for re-routing the drive cables 2306 as described above. Here, a first of the drive cables 2306a extends downward from the drive nut 2302, around the guide member 2314 where it is re-routed upward, and around a first track of the double pulley 2308; a second of the drive cables 2306b extends downward from the drive nut 2302 and around a first track of the double pulley 2310, such that it moves in the same direction as the first drive cable 2306a; a third of the drive cables 2306c extends upward from the drive nut 2302 and around a second track of the double pulley 2308; and a fourth of the drive cables 2306d extends upward from the drive nut 2302, around the guide member 2312 where it is re-routed downward, and around a second track of the double pulley 2310, such that it moves in the same direction as the third drive cable 2306c.

The drive cables 2306 are adjustably connected to one or more aspects of the screw drive assembly 2300. In some

examples, the drive cables 2306 are adjustably connected to the drive nut 2302, such that the tension of the drive cables 2306 may be adjusted at the drive nut 2302. FIG. 24 illustrates an example of the drive nut 2302 configured to permit adjustment of the drive cables 2306, according to one or more embodiments. In the illustrated examples, each of the drive cables 2306 (i.e., the first, second, third, and fourth drive cables 2306a-d) include a threaded rod 2402 at their ends proximate to the drive nut 2302. The drive cables 2306 may also include threaded rod (not illustrated) at their other terminal end proximate to the slide-out room 22. The threaded rod 2402 of the drive cables 2306 may be secured to the drive nut 2302 via a nut 2404, whereby rotation of the nut 2404 causes the threaded rod 2402 to translate linearly through the drive nut 2302. Thus, the nut 2404 may be rotated in a first direction to move the threaded rod 2402 in a first direction that tensions the corresponding drive cable 2306, or rotated in a second direction to move the threaded rod 2402 in a second opposite direction that un-tensions the corresponding drive cable 2306. Lock washers may be utilized to maintain tension in the drive cables 2306. For example, lock washers may be provided on a side of the drive nut 2302 opposite of the nut 2304. Alternatively, lock washers may be provided within the drive nut 2302.

FIGS. 25-27 illustrate an exemplary drive assembly 2500 that articulates the slide-out room 22 via a block and tackle configuration, according to one or more embodiments. FIG. 25 illustrates the drive assembly 2500 from an interior of the vehicle 10. The drive assembly 2500 includes at least one block and tackle assembly 2502. In the illustrated example, the drive assembly 2500 is secured to the vehicle 10 at a location beneath the slide-out room 22 and includes a pair of block and tackle assemblies 2502a,2502b corresponding with the left and right side of the slide-out unit 22. In other examples, however, the drive assembly 2500 may be secured to the vehicle 10 at a location above the slide-out room 22. In even other examples, the drive assembly 2500 may be differently arranged about the slide-out room 22, for example proximate to the left or right side of the opening 18 in the vehicle 10, and the block and tackle assemblies 2502a,2502b may correspond with a top and bottom of the slide-out room 22.

Here, the drive assembly 2500 includes a drive sprocket 2504 that articulates the block and tackle assemblies 2502a, 2502b. The drive sprocket 2504 may be driven by a variety of means. For example, the drive sprocket 2504 may be connected to a motor or other actuator or may be manually driven via a crank shaft. In the illustrated example, the drive sprocket 2504 is configured as a double sprocket that drives a pair of drive chains 2506a,2506b, with the block and tackle assembly 2502a connected to the ends of the drive chain 2506a and the block and tackle assembly 2502b connected to the ends of the drive chain 2506b.

FIG. 26 illustrates the block and tackle assembly 2502 of FIG. 25, according to one or more embodiments. While FIG. 26 illustrates only one block and tackle assembly 2502 (e.g., the block and tackle assembly 2502a), it will be appreciated that both of the block and tackle assemblies 2502a,2502b may be similarly configured.

The block and tackle assembly 2502 includes a pair of moving blocks 2602a,2602b that are each connected to the drive chain 2506. The block and tackle assembly 2502 further includes a pair of fixed blocks 2604a,2604b that are connected to the vehicle 10. As illustrated, the moving blocks 2602a,2602b and the fixed blocks 2604a,2604b are



each configured as double pulleys (or double blocks), and thus each include a pair of pulleys that may rotate independent from each other.

The block and tackle assembly **2502** includes four (4) drive cables **2608**. Each of the drive cables **2608** is provided as a cable length having a pair of cable ends **2610**, with a first cable end (obscured from view) being affixed to the slide-out unit **22** and the second cable end **2610** being attached to the vehicle **10**. Here, the four (4) drive cables **2608** are routed, from their cable ends **2610**, around the moving blocks **2602a,2602b** and around the fixed blocks **2604a,2604b**, to the opposing cable ends secured to the slide-out room **22**. Thus, the drive cables **2608** are each arranged about the moving blocks **2602a,2602b** and the fixed blocks **2604a,2604b** in a double tackle configuration, such that rotation of the moving blocks **2602a,b** via the drive chain **2506** in a first rotational direction causes two (2) of the drive cables **2608** to be pulled towards the opening **18** in the vehicle and causes the other two (2) of the drive cables **2608** to be pushed away (i.e., slackens) from the opening **18** in the vehicle **10**.

The drive cables **2608** may be adjustably attached to the vehicle **10**. Here, for example, each of the drive cables **2608** is adjustably attached to a frame member **2612** that is secured to the vehicle **10**. In the illustrated example, each cable end **2610** of the drive cables **2608** includes a stud **2614** extending therefrom and a threaded rod **2616** extending from the stud **2614**. The threaded rod **2616** may be rotatably attached to the stud **2614** such that the stud **2614** and the threaded rod **2616** may rotate relative to each other, and thereby inhibit twisting of the drive cables **2608** when tensioning the same as hereinafter described. The threaded rod **2616** extends through an aperture **2618** in the frame member **2612** and is received by a nut **2620**, whereby rotation of the nut **2620** causes axial translation of the threaded rod **2616** through the aperture **2618**, thereby adding tension or removing tension from the drive cable **2608** corresponding therewith. In this example, rotation of the drive cable **2608** may be inhibited via the joint coupling stud **2614** and the threaded rod **2616** and permits relative rotation there between.

Different means may be utilized to adjustably connect the drive cables **2608** to the frame member **2612**, however. For example, the frame member **2612** may include four (4) cable adjustment mechanisms (not illustrated) that are rotatably attached within apertures **2618** in the frame member **2612**, such that each of the cable adjustment mechanisms may rotate within the apertures **2618** of the frame member **2612**. Also in this example, each of the cable adjustment mechanisms is configured as an elongated nut having a threaded bore for receiving a threaded rod or stud that is connected to the cable ends **2610** of the drive cable **2608**. The threaded rod includes a thread that corresponds with the thread of the cable adjustment mechanism. Thus, rotation of the cable adjustment mechanism will cause the threaded rod arranged therein to translate axially within the threaded bore of the cable adjustment mechanism, thereby adding tension or removing tension from the drive cable **2608** associated therewith. In some examples, the cable ends **2610** of the drive cable **2608** include a joint configured to permit relative rotation between the threaded rod and the drive cables **2608**, to thereby inhibit the drive cables **2608** from being twisted when tensioning them.

Other means may be utilized to adjust the drive assembly **2500**. FIG. **27** illustrates a close up of the moving blocks **2602a,2602b** configured to be adjusted relative to the drive chain **2506**. The drive chains **2506** may each be provided as a segment or strand of chain having two opposing ends

**2700a,2700b** that are unconnected to each other (i.e., an open chain configuration). In such embodiments, the moving blocks **2602a,2602b** are connected to the opposing ends **2700a,2700b**, respectively, of the drive chain **2506**. The moving blocks **2602a,2602b** may be adjustably connected to the drive chain **2506**, which may facilitate adjusting the tension in drive assembly **2500** to ensure smooth and even movement of the slide-out room **22** driven thereby. Here, a stud **2702** is coupled to each of the opposing ends **2700a,2700b** via a link bracket **2704** that is pinned to one or more links of the drive chain **2506**. The studs **2702** are attached to the link brackets **2704** and, in some examples, are permitted to rotate relative to the link brackets **2704**. The studs **2702** include a threaded portion and extend through a corresponding aperture (obscured from view) in the frames of the moving blocks **2602a,2602b**. An adjustment nut **2706** is provided within the moving blocks **2602a,2602b**, and a second nut **2708** may be provided exterior of the moving blocks **2602a,2602b** on the opposite side of the aperture from the adjustment nut **2706**. The adjustment nut **2706** may be rotated to linearly translate the threaded portions of the studs **2702** within the aperture of the moving blocks **2602a,2602b**, and thereby adjust the tension of the moving blocks **2602a,2602b** and the drive cables **2608** arranged therein relative to the drive chain **2506**. In addition, one or more lock washers may be utilized to help lock the location of the stud **2702** relative to the moving blocks **2602a,2602b**.

Other means of adjusting the drive cables **2608** may be provided in addition to or in lieu of the foregoing. For example, the fixed blocks **2604a,2604b** may be adjustably secured to the vehicle **10** such that they may move to adjust the tension of the drive cables **2608** arranged therein. In one non-illustrated example, the fixed blocks **2604a,2604b** are secured on tracks within the vehicle **10** and may slide along the tracks as needed to adjust the tension in the drive cables **2608**. For example, tracks may be provided on an interior wall or frame of the vehicle **10** proximate to the opening **18**, and the fixed blocks **2604a,2604b** may be configured to translate along those tracks in a direction approximately perpendicular to the direction in which the drive chain **2506** rotates. Here, a ratchet mechanism may be utilized to translate either or both of the fixed blocks **2604a,2604b** along the tracks. The fixed blocks **2604a,2604b** may be adjusted together via a single ratchet mechanism, or they may be adjusted individually via separate ratchet mechanisms. Thus, the ratchet mechanism or other means may be utilized to move either or both of the fixed blocks **2604a,2604b** downward (away from the slide-out room **22**) to thereby add tension to the drive cables **2608** associated with the fixed blocks **2604a,2604b** that have been ratcheted to a new location.

The drive chain and/or the drive cables may be differently configured to articulate the slide-out room **22**. FIGS. **28-29** illustrate exemplary slide-out drive assemblies **2800,2900**, wherein movement of the slide-out room **22**, via a first of a plurality of drive cable (or a first cable end of a first of a pair of drive cables), engages one or more of the remaining drive cables (or one or more of the remaining cable ends of the pair of drive cables) to simultaneously pull the slide-out room **22** in the same direction, according to one or more alternate embodiments. In this manner, the slide-out drive assemblies **2800,2900** (hereinafter, the drive assemblies **2800,2900**) tension a single drive cable (or a single cable end of a first drive cable) to move the slide-out room **22** in a first direction, which in turn synchronizes activation or tensioning of one or more remaining drive cables (or cable ends of a second drive cable). As more fully described



below, the drive assembly **2800** of FIG. **28** includes a discontinuous segment or strand of drive chain; whereas, the drive assembly **2900** of FIG. **29** utilizes a continuous loop of drive chain, which may permit utilization of a timing shaft. Regardless of the configuration of the drive chain, however, the drive chain of both drive assemblies **2800,2900** tensions a single cable (or single cable end) to move the slide-out room **22**, and at least one of the remaining cables (or cable ends) are tensioned via such movement of the slide-out room **22** such that the slide-out drive assemblies **2800,2900** synchronize movement of the remaining cables or cable ends through the slide-out room **22**.

The slide-out drive assemblies **2800,2900** may be jamb mounted and, therefore, are shown incorporated into the left and right jamb assemblies **1410a,b** of FIG. **14**. However, the drive assemblies **2800,2900** may instead be incorporated into either the left jamb assembly **1410a** or the right jamb assembly **1410b**, or the drive assemblies **2800,2900** may be incorporated into a top and/or bottom jamb assembly in addition to or in lieu of either or both of the left and right jamb assemblies **1410a,1410b**.

As more fully described below, the drive assemblies **2800,2900** may actuate a plurality of drive cables, which are routed through either or both of the left and right jamb assemblies **1410a,1410b**. In the illustrated example, each of the left and right jamb assemblies **1410a,1410b** includes four drive cables routed there-through, from the drive chain, to opposing sides of the slide-out room **22**; however, as previously mentioned, the four drive cables may be provided in just one of the left or right jamb assemblies **1410a,1410b**. Thus, in these examples, the drive chain tensions a first of four drive cables to pull the slide-out room **22** in a first direction, which causes the slide-out room **22** to activate or tension two of the remaining three drive cables to pull the slide-out room **22** in the first direction, simultaneously with the first drive cable. In other examples, the left and right jamb assemblies **1410a,1410b** each includes a pair (i.e., two) of drive cables routed there-through and interconnecting opposing sides of the slide-out room **22**, where at least one of the two drive cables is secured relative to the drive chain; however, as previously mentioned, the two drive cables may be provided in just one of the left or right jamb assemblies **1410a,1410b**. In this latter example, each of the pair of drive cables is connected to the drive chain at a connector, and the opposing ends or portions of each drive cable extending from the connector may each be conceptualized as an individual drive cable, such that the pair of drive cables effectively functions as if it had four drive cables. Thus, in these examples, the drive chain tensions a first cable end of the first drive cable to pull the slide-out room **22** in a first direction, which causes the slide-out room **22** to activate or tension the second drive cable's opposing cable ends to pull the slide-out room **22** in the first direction simultaneously with the first drive cable's first cable end.

With reference to FIG. **28A**, the drive assembly **2800** is incorporated into the left and right jamb assemblies **1410a, 1410b**. However, the drive assembly **2800** may be incorporated into other jamb assemblies or combination of jamb assemblies provided about the opening **18** of the vehicle **10**. FIG. **28B** illustrates an individual jamb assembly (e.g., the left or right jamb assembly **1410a,1410b**) incorporating the drive assembly **2800**; however, it will be appreciated that one or more other jamb assemblies arranged around the slide-out room **22** may be similarly configured. As illustrated, the drive assembly **2800** includes a motor **2802** and a drive chain **2804**. A drive sprocket (obscured from view) is operatively coupled to the motor **2802**, and the drive chain

**2804** extends around and engages the teeth of the drive sprocket, such that the motor **2802** may impart rotation on the drive sprocket (e.g., clockwise or counter-clockwise) to correspondingly drive or rotate the drive chain **2804**. For example, clockwise rotation of the drive sprocket rotates the drive chain **2804** as indicated by directional arrows **R1**, whereas counter-clockwise rotation of the drive sprocket would reverse movement of the drive chain **2804** in an opposite direction.

The motor **2802** may be positioned at various locations relative to the slide-out room **22**. In the illustrated example, the motor **2802** is mounted within an upper end of the frame members **1420** of the jamb assemblies **1410a,1410b** and thus oriented proximate to the ceiling **32** of the slide-out room **22**. However, the motor **2802** may be located elsewhere relative to the slide-out room **22**, for example, located about the floor of the slide-out room **22** (see, for example, FIG. **29A**) or located at various locations there-between.

As with other embodiments described herein, the drive assembly **2800** may be configured to synchronize or time the operation of the jamb assemblies **1410a,1410b**. For example, the drive assembly **2800** may be configured to electronically time or synchronize operation of the motors **2802** mounted in the frame members **1420** of the opposing jamb assemblies **1410a,1410b** and drive chains **2804** drive thereby. In the illustrated example, the drive assembly **2800** utilizes sensors and/or feedback to electronically time or synchronize operation of the motor **2802** incorporated in the left jamb assembly **1410a** with the motor **2802** incorporated in the right jamb assembly **1410b**. However, other means (electronic or mechanical) may be utilized to time or synchronize operation of the jamb assemblies **1410a,1410b**, in addition to or in lieu of the foregoing. For example, timing or synchronization may be achieved via a timing shaft (or belt) arranged under the floor of the slide-out room **22** and/or connecting or linking (i.e., hard-wiring or wireless) the motors **2802** of the jamb assemblies **1410a,1410b** to allow communication there-between.

In some embodiments, electronic timing of the motors **2802** is accomplished via Back Electromotive Force voltage ("BEMF" or "back EMF"). During operation, each of the motors **2802** may generate a back EMF, which is an electromotive force or voltage that opposes the change in current which induced it. Back EMF may be monitored and utilized to adjust voltage input to control the speed of either or both of the motors **2802**. For example, a supply voltage is applied to a first motor **2802** and a second motor **2802**, and this supply voltage causes the first and second motors **2802** to operate at respective output speeds. Operation of the first motor **2802** at its output speed generates a back EMF in the first motor **2802** that is proportional to its output speed and, similarly, operation of the second motor **2802** at its output speed generates a proportional back EMF in the second motor **2802**. However, variations in one or both of the motors **2802** (e.g., differences in supplied voltages, differences in efficiencies, etc.) may result in unsynchronized operation of the motors **2802**, which may in turn result in uneven extension or retraction of the slide-out room **22** (i.e., the drive assembly **2800** incorporated into the left jamb assembly **1410a** may operate faster or slower than the drive assembly **2800** incorporated into the right jamb assembly **1410b**). Accordingly, the drive assembly **2800** in opposing jamb members **1410a,1410b** may be electronically synchronized or timed using back EMF.

The drive assembly **2800** in opposing jamb members **1410a, 1410b** may be electronically timed by reading back EMF in the first and second motors **2802** and controlling



their operation based on the measured or sensed back EMF. For example, a system **2801** may measure or read the back EMF in both the first motor **2802** and/or the second motor **2802**, and compare these back EMF readings to identify a discrepancy between the back EMF in the first motor **2802** and the back EMF in the second motor **2802**. Upon sensing a difference in back EMF between the first and second motor **2802**, voltage supplied to the first motor **2802** and/or the second motor **2802** may be controlled to adjust the output speed of the first and/or second motor **2802**. Thus, the system may time or synchronize operation of the first and second motors **2802** by comparing their back EMFs and then adjusting the voltage supplied to the faster and/or slower motor **2802** to equalize their output speeds. Such systems may include various types of sensors configured to measure back EMF. However, the system may instead (or in addition to sensors) utilize sensorless techniques to detect back EMF in the motors **2802**, and such sensorless techniques may include various types of comparator circuits, controllers, and/or microcontrollers. Accordingly, the system may incorporate various components, systems, and methods for controlling motor velocity utilizing feedback indicative of back EMF, including those disclosed in U.S. Pat. No. 5,811,946 which is incorporated by reference in its entirety.

In some examples, a controller **2880** may determine that the back EMF in the first motor **2802** is greater than the back EMF sensed in the second motor **2802** because the first motor **2802** is operating faster than the second motor **2802**. Here, the electronics (e.g., a controller **2880**) of the drive assembly **2800** may then limit or reduce the voltage supplied to the first motor **2802** a sufficient amount to thereby decrease the speed of the first motor **2802** such that the first motor **2802** operates at the same speed as the second motor **2802** (i.e., slowing down the first motor **2802** to match the speed of the second motor **2802**). This results in the first and second motors **2802** rotating their drive sprockets and drive chains **2804** at equal rates or speeds such that the slide-out room **22** is evenly extended or retracted at its opposing sides. In other examples, upon sensing that the back EMF in the first motor **2802** is greater than the back EMF sensed in the second motor **2802** (i.e., the first motor **2802** is operating faster than the second motor **2802**), the controller **2880** may increase the voltage supplied to the second motor **2802** to thereby increase the speed of the second motor **2802** (i.e., speeding up the second motor **2802**) to match or equal the output speed of the first motor **2802**. This will also result in the first and second motors **2802** rotating their drive sprockets and drive chains **2804** at equal rates that permit even extension or retraction of the slide-out room **22** at its opposing sides. In even other examples, the voltage in both the first motor **2802** and the second motor **2802** may be adjusted to equalize their output speeds upon detection of a difference between the back EMF in the first motor **2802** and the back EMF in the second motor **2802** (i.e., slowing down the first motor **2802** and speeding up the second motor **2802** to equalize output speeds of the first and second motors **2802**).

The drive chain **2804** may be provided as a non-continuous (or open) segment or strand of chain, which maintains engagement with the drive sprocket as it rotates in either direction. Here, for example, the drive chain **2804** is a U-shaped strand having opposing free ends **2806a,2806b**. However, the drive chain **2804** may have different non-continuous configurations or, as more fully described below, the drive chain **2804** may be provided as a continuous (or closed) segment or loop of chain.

Each of the opposing free ends **2806a,2806b** of the drive chain **2804** may be connected, adjustably or otherwise, to one or more drive cables. In the illustrated example, each of the opposing free ends **2806a,2806b** of the drive chain **2804** is coupled to a pair of drive cables, with the first opposing free end **2806a** of the drive chain **2804** connected to a first drive cable **2810a** and a second drive cable **2810b** and the second opposing free end **2806b** of the drive chain **2804** connected to a first drive cable **2812a** and a second drive cable **2812b**. Thus, in this example, there are four drive cables **2810a,2810b,2812a,2812b**. As discussed below, each of the drive cables **2810a,2810b,2812a,2812b** is routed through the jamb assembly **1410** towards opposite sides of the slide-out room **22**, with a cable end **2814a** of the first drive cable **2810a** connected to an exterior (or outer) side of the slide-out room **22**, a cable end **2814b** of the second drive cable **2810b** connected to an interior (or inner) side of the slide-out room **22** (opposite the exterior side thereof), a cable end **2816a** of the second drive cable **2812a** connected to the interior side of the slide-out room **22**, and a cable end **2816b** of the second drive cable **2812b** connected to the exterior side of the slide-out room **22**. The cable ends **2814a,2814b,2816a,2816b** may be connected at various locations about the slide-out unit **22** and, in some examples, are secured at the corners of a sidewall **34** (and/or opposing sidewall **36**) of the slide-out unit **22**. Here, the cable end **2814a** of the first drive cable **2810a** is routed through the jamb assembly **1410** and connected to a bracket secured at an outer lower corner A of the slide-out room **22**; the cable end **2814b** of the second drive cable **2810b** is routed through the jamb assembly **1410** and connected to a bracket secured at an inner upper corner D of the slide-out room **22**; the cable end **2816a** of the first drive cable **2812a** is routed through the jamb assembly **1410** and connected to a bracket secured at an inner lower corner B of the slide-out room **22**; and the cable end **2816b** of the second drive cable **2812b** is routed through the jamb assembly **1410** and connected to a bracket secured at an outer upper corner C of the slide-out room **22**. As mentioned, in other examples, each of the opposing free ends **2806a,2806b** of the drive chain **2804** is coupled to one drive cable, with the first opposing free end **2806a** of the drive chain **2804** connected to a first drive cable and the second opposing free end **2806b** of the drive chain **2804** connected to a second drive cable. Here, the first drive cable (connected to free end **2806a** of the drive chain **2804**) includes opposing first and second ends routed through the jamb assembly **1410** and connected to the slide-out room **22** at the outer lower corner A and the inner upper corner D, respectively, and the second drive cable (connected to the opposing free end **2806b**) includes opposing first and second ends routed through the jamb assembly **1410** and connected to the slide-out room **22** at the inner lower corner B and the outer upper corner C. The drive assembly **2800**, however, operates in a similar manner regardless of how many discrete drive cables are utilized.

FIG. **28C** illustrates the opposing free ends **2806a,2806b** of the drive chain **2804**, according to one or more embodiments of the present disclosure. The four drive cables **2810a,2810b,2812a,2812b** each include a chain end at which they are coupled to the drive chain **2804**. Here, a pair of cable connectors **2807** is attached at each opposing free end **2806a,2806b**, such that each individual cable connector **2807** couples one of the four drive cables **2810a,2810b,2812a,2812b** to the drive cable **2804**. Also, the chain end of each of the four drive cables **2810a,2810b,2812a,2812b** includes a bead or retention member **2809** configured to engage the cable connector **2807** associated therewith. In



some examples, the beads **2807** permit some movement of the drive cables **2810a,2810b,2812a,2812b** while inhibiting other movements. For example, the beads **2809** may permit rotation of the drive cables **2810a,2810b,2812a,2812b** relative to the cable connector **2807**, and may permit axial movement of drive cables **2810a,2810b,2812a,2812b** in one direction while inhibiting axial movement in the opposite direction. Here, the beads **2809** are sized larger than an aperture in the cable connector **2807** through which the chain end of the respective drive cable extends, such that the cable connector **2807** will engage the bead **2809** when the drive chain **2804** is rotated, thereby pulling the drive cable associated therewith. In this example, the bead **2807** is not rigidly secured to the cable connector **2807** such that, when the chain **2804** is rotated in a direction causing the free ends **2806a,2806b** thereof to move towards the chain end of the drive cables, the cable connector **2807** may travel independent of its associated drive cable, with the aperture of the cable connector **2807** moving relative to the associated chain end. Thus, the beads **2809** may permit the cable connector **2807** to pull one of the drive cables **2810a,2810b,2812a,2812b** without the cable connector **2807** engaging or activating one or more of the remaining drive cables **2810a,2810b,2812a,2812b**. For example, movement of the drive chain in direction **R1** may activate or tension the cable end **2814a** of the first drive cable **2810a**, and thereby pull the first drive cable **2810a**, while the cable connector **2807** associated with the second drive cable **2810b** travels over the chain end of the second drive cable **2810b** such that the drive chain **2804** fails to engage or activate (i.e., fails to push) the cable end **2814b**. In other examples, however, one or more of the beads **2809** may be fixed to its respective cable connector **2807** to inhibit relative axial movement in both axial directions, such that the cable connector **2807** would impart compression (or push) on the associated drive cable.

Referring again to FIGS. **28A** and **28B**, the drive cables **2810a,2810b,2812a,2812b** are each routed, from the drive chain **2804**, about one or more pulleys to the slide-out room **22**. In the illustrated example, each of the jamb assemblies **1410a,1410b** of the drive assembly **2800** includes a pair of cable guides **2818,2820**. Here, the first cable guide **2818** is mounted within an upper portion of the frame member **1420** proximate to the ceiling **32** of the slide-out unit **22** and the second cable guide **2820** is mounted within a lower portion of the frame member **1420** proximate to the floor of the slide-out unit **22**. Thus, the pair of cable guides **2818,2820** may be individually referred to as the upper cable guide **2818** and the lower cable guide **2820**. However, the pair of cable guides **2818,2820** may be differently arranged within the frame member **1420**. The pair of cable guides **2818,2820** may each be configured as double pulleys that permit independent actuation of the drive cables **2810,2812**, and may thus each include an individual or unique cable track for individually accommodating each of the drive cables **2810a,2810b,2812a,2812b**; however, either or both of the pair of cable guides **2818,2820** may be differently configured, for example, as a pair of individual pulleys (i.e., single pulleys). Also in the illustrated example, a cable idler **2822** is provided to redirect the path of the drive cables **2810b,2812b**. Here, the cable idler **2822** is arranged within an upper portion of the frame member **1420**, proximate to the upper cable guide **2818**, but may be arranged elsewhere within the frame member **1420**, for example, at a lower portion thereof proximate to the lower cable guide **2820** to redirect the drive cables **2810a,2812a**, or at various other locations therebetween. The cable idler **2822** may also be configured as a double pulley, such that it may redirect and guide a pair of

the drive cables **2810b,2812b**, without interference, rubbing, or friction between the drive cables **2810b,2812b**. In other examples, one or more additional cable idlers may be provided, whether as single and/or as double pulleys, to redirect or re-route one or more of drive cables **2810a,2810b,2812a,2812b**. In the illustrated example, the pair of cable guides **2818,2820** and the cable idler **2822** are all attached to the web portion of the frame member **1420**; however, one or more of them may be mounted on a sidewall of the frame **1420**.

As illustrated, the chain ends of the first and second drive cables **2810a,2812b** are attached to the free end **2806a** of the drive chain **2804**, and the opposing cable ends **2814a,2814b** associated therewith extend in opposite directions therefrom towards the opposing outer and inner sides, respectively, of the slide-out room **22**. The cable end **2814a** of the first drive cable **2810a** extends downward from the free end **2806a** of the drive chain **2804**, towards a lower end of the frame member **1420**, around a first cable track of the lower cable guide **2820**, and outward from an outward facing opening in the frame member **1420**, towards the outer side of the slide-out room **22**. The cable end **2814b** of the second drive cable **2810b** extends upward from the free end **2806a** of the drive chain **2804**, towards the upper end of the frame member **1420**, along a first cable track of the cable idler **2822**, over and around a first cable track of the upper cable guide **2818**, and outward from an inward facing opening in the frame member **1420**, towards the inner side of the slide-out room **22**.

Similarly, the chain ends of the first and second drive cables **2812a,2812b** are attached to the free end **2806b** of the drive chain **2804**, and the opposing cable ends **2816a,2816b** associated therewith extend in opposite directions therefrom towards the opposing inner and outer sides, respectively, of the slide-out room **22**. The cable end **2816a** of the first drive cable **2812a** extends downward from the free end **2806b** of the drive chain **2804**, towards the lower end of the frame member **1420**, around a second cable track of the lower cable guide **2820**, and outward from an inward facing opening in the frame member **1420**, towards the inner side of the slide-out room **22**. The cable end **2816b** of the second drive cable **2812b** extends upward from the free end **2806b** of the drive chain **2804**, toward the upper end of the frame member **1420**, along a second cable track of the cable idler **2822**, over and around a second cable track of the upper cable guide **2818**, and outward from an outward facing opening in the frame member **1420**, towards the outer side of the slide-out room **22**.

Thus, the first and second drive cables **2810a,2810b** associated with the free end **2806a** of the drive chain **2804** connect to opposite sides of the slide-out room **22**, and the first and second drive cables **2812a,2812b** associated with the opposing free end **2806b** of the drive chain **2804** similarly connect to opposite sides of the slide-out room **22**. Also, the drive cables **2810a,2810b,2812a,2812b** may connect to the slide-out room **22** at various vertical dimensions along the slide-out room **22**. For example, the first and second drive cables **2810a,2810b** that connect to opposite sides of the slide-out room **22** are positioned at lower and upper ends, respectively, of the slide-out room **22**; and the first and second drive cables **2812a,2812b** that also connect to opposite sides of the slide-out room **22** are similarly attached at lower and upper ends of the slide-out room **22**. In the illustrated example, the cable end **2814a** of the first drive cable **2810a** connects to the outer lower corner **A** of the slide-out room **22**, the cable end **2816a** of the (second) first drive cable **2812** connects to the inner lower corner **B** of the



slide-out room **22**, the cable end **2814b** of the second drive cable **2810b** connects to the inner upper corner D of the slide-out room **22**, and the cable end **2816b** of the (second) second drive cable **2812b** connects to the outer upper corner C of the slide-out room **22**; however, either or both of the cable ends **2814a,2816a** may instead be routed towards an upper corner (or upward from the lower end) of the slide-out room **22** and/or either or both of the cable ends **2814b,2816b** may instead be routed towards a lower corner (or downward from the upper end) of the slide-out room **22**).

The drive assembly **2800** generally operates as follows. The motor **2802** actuates the drive chain **2804** in the clockwise direction, causing the opposing free ends **2806a,2806b** to move in corresponding directions as indicated by arrow **R1**. This movement of the free end **2806a** creates interference between the cable connector **2807** and the bead **2809** of the first drive cable **2810a**, such that the free end **2806a** tensions the first drive cable **2810a** and pulls the slide-out room **22** in a first direction as indicated by arrow **D1**. The first drive cable **2810a** is connected proximate to the outer lower corner A of the slide-out room **22**, and thus pulls the slide-out room **22** in the first direction **D1** from that outer lower corner A. The second first drive cable **2812a** is connected to an opposite side of the slide-out room **22**, at the inner lower corner B, and the slide-out room **22** carries or pulls the first drive cable **2812a** with it as it moves in the first direction **D1**, thereby activating or tensioning the first drive cable **2812a**. Also, the first drive cable **2812a** is connected relative to the second drive cable **2812b**, such that they are pulled together. Here, for example, they are interconnected via a segment **2813** of chain at the free end **2806b** of the drive chain **2804**. Thus, movement of the slide-out room **22** in this first direction **D1** engages or tensions the first drive cable **2812a** (associated with the free end **2806b**) at the inner lower corner B, which in turn engages or tensions the segment **2813** of chain at the free end **2806b**, which in turn engages or tensions the second drive cable **2814b** attached to the outer upper corner C of the slide-out room **22**. In this manner, the first cable **2812a**, the segment **2813** of chain, and the second drive cable **2812b** effectively operate as an individual drive cable, and together pull the slide-out room **22** in the first direction **D1**, in concert with the first drive cable **2810a**.

In particular, the rotation of the drive chain **2804** moves the chain ends **2806a,2806b** in opposite directions. For example, rotation of the drive chain **2804** in a clockwise direction **R1** moves the chain ends **2806a,2806b** upward and downward directions, respectively. Here, the first drive cable **2810a** is connected to the chain end **2806a**, which pulls it in a corresponding direction **D1** to create tension in the first cable end **2814a** to retract the slide-out room **22**. This rotation of the drive chain **2802**, however, may not pull the remaining drive cables **2810b,2812a,2812b** to create tension in the corresponding cable ends **2814b,2816a,2816b**. Similarly, opposite rotation of the drive chain **2804** pulls the first drive cable **2812a** in a corresponding opposite direction to create tension in the first cable end **2816a** to extend the slide-out room **22**. Thus, the drive chain **2804** may engage or tension just one of the first drive cable **2810a** or the first drive cable **2812a**, and then the slide-out room **22** may activate the remaining drive cables.

In the illustrated example, the cable end **2814a** of the first drive cable **2810a** is connected to a bracket positioned at the outer lower corner A of the slide-out room **22**, such that this rotation of the drive chain **2804** pulls (or moves) the slide-out room **22** in a first direction **D1** from the outer lower corner A. Also, the cable end **2814b** of the second drive

cable **2810b** is connected to a bracket positioned at the inner upper corner D of the slide-out room **22**, such that the chain end **2806a** of the drive chain **2804** pushes and/or provides slack to (or slackens) the second drive cable **2810b** as the slide-out room **22** is pulled (or moved) in the first direction **D1** via the first cable end **2814a**. Also, the cable end **2816a** of the first drive cable **2812a** is connected to a bracket positioned at the inner lower corner B of the slide-out room **22**, on an opposite side of the slide-out room **22** from the outer lower corner A, such that the slide-out room **22** pulls the drive cable **2812a** as it moves in the first direction **D1**, thereby tensioning the second drive cable **2812b** which is secured relative to the first drive cable **2812a**. Here, the cable end **2816b** of the second drive cable **2812b** is connected to a bracket positioned at the outer upper corner C of the slide-out room **22** and movement of the slide-out room **22** in the first direction **D1**, via the first drive cable **2810a**, tensions the first and second drive cables **2812a,2812b** to pull the slide-out room **22** at the outer upper corner C in the first direction **D1**. Thus, rotation of the drive chain **2804** engages (or tensions) the first drive cable **2810a** to pull (or move) the slide-out room **22** in the first direction **D1**, and the resulting movement of the slide-out room **22** in the first direction **D1** engages the second drive cable **2812b** to also pull (or move) the slide-out room **22** in the first direction **D1**. Similarly, rotation of the drive chain **2804** in the opposite direction engages (or tensions) the first drive cable **2812a** to pull (or move) the slide-out room **22** in a second direction (that is opposite the first direction **D1**), and the resulting movement of the slide-out room **22** in the second direction engages the second drive cable **2810b** to also pull (or move) the slide-out room **22** in the second direction.

Depending on where the cable end **2814a** of the drive cable **2810a** is connected on the outer surface of the slide-out room **22** (e.g., at the outer lower or outer upper corner A,C, or there-between), the inner surface of the slide-out room **22** may or may not move evenly, for example, the inner lower corner B of the slide-out room **22** may move a different amount (and/or differently) at the inner lower corner B. But for the slide-out room **22** engaging one or more of the remaining drive cables, this may otherwise result in tipping (or rocking, tilting, etc.) of the slide-out room **22**, because the chain end **2806a** of the drive chain **2804** pushing (or moving, carrying, etc.) the cable end **2814b** of the drive cable **2810b** may fail to generate (or be incapable of generating) sufficient force to move the inner upper corner D of the slide-out room **22** in unison with the inner lower corner B; and, similarly, the chain end **2806b** of the drive chain **2804** pushing (or moving, carrying, etc.) the drive cable **2812b** in this direction may otherwise fail to generate (or be incapable of generating) sufficient tension in the cable end **2816b** of the drive cable **2812b** to pull the outer upper corner C of the slide-out room **22** in unison with the inner lower corner B. Thus, when activating the cable end **2814a** via the drive chain **2804** to pull the outer lower corner A of the slide-out room **22** in the first direction **D1**, driven rotation of the drive chain **2804** may cause no movement of the outer upper corner C of the slide-out room **22** or may cause movement (or travel) in the first direction **D1** less than the outer lower corner A; and, moreover, driven rotation of the drive chain **2804** may otherwise cause the outer upper corner C of the slide-out room **22** to move (or travel) in the first direction **D1** less than the inner lower corner B, resulting in the inner lower corner B engaging (or tensioning) the drive cables **2812a,2812b** to pull the outer upper corner C of the slide-out room **22** simultaneously with the outer lower corner A. Accordingly, the drive assembly **2800** may be



configured to deploy the slide-out room 22 into its extended and retracted positions with a desired orientation and/or be configured to adjust orientation of the slide-out room 22 during deployment of the same.

The drive assembly 2800 cycles the drive chain 2804 to pull or engage just one drive cable 2810a, 2810b, 2812a, 2812b. This causes movement of the slide-out room 22, which in turn activates the remaining drive cables 2810a, 2810b, 2812a, 2812b. Thus, all of the drive cables 2810a, 2810b, 2812a, 2812b are activated by pulling just one of them, which moves the slide-out room 22 at one corner and sets the remaining corners of the slide-out room 22 in motion.

FIGS. 29A-29C illustrate an alternate drive assembly 2900, according to one or more alternate embodiments. With reference to FIGS. 29A-29B, the drive assembly 2900 may be incorporated into the left and right jamb assemblies 1410a, 1410b as previously described with regard to the drive assembly 2800 of FIGS. 28A and 28B. Thus, as to each of the jamb assemblies 1410a, 1410b, the drive assembly 2900 includes a motor 2902 and a drive chain 2904. A drive sprocket (obscured from view) is operatively coupled to the motor 2902, and the drive chain 2904 extends around and engages the teeth of the drive sprocket, such that the motor 2902 may impart torque on the drive sprocket, causing it to rotate and drive or move the drive chain 2904. Also, an idler sprocket 2906 may be provided in each of the opposing jamb assemblies 1410a, 1410b for guiding and maintaining orientation of the drive chain 2904 as it is actuated by the drive sprocket of the motor 2902. Here, the drive chain 2904 is provided as a continuous (or closed) segment or loop of chain arranged around the drive sprocket and the idler sprocket 2906 to maintain engagement with the drive sprocket as it rotates in either direction, such that the drive chain 2904 transmits power to the idler sprocket 2906 so that the idler sprocket 2906 rotates with the drive sprocket.

As illustrated, a timing shaft 2908 may extend between and interconnects the idler sprockets 2906 of the opposing jamb assemblies 1410a, 1410b, such that they rotate in unison and operation of the drive assembly 2900 within each of the opposing jamb assemblies 1410a, 1410b is synchronized or timed together. However, other mechanical timing mechanisms and/or non-mechanical timing systems may be utilized in addition to or in lieu of the foregoing. Also, it will be appreciated that the timing shaft 2908 (or other timing mechanism) may be provided at various locations about the slide-out room 22, for example, across a top side of the slide-out room 22, along a bottom side thereof, or along a sidewall thereof depending on the location about the slide-out room 22 that the drive assembly 2900 is oriented. Thus, the drive assembly 2900 is a variation of the drive assembly 2800 of FIGS. 28A-28C, wherein the motor 2902 is positioned at a lower side of the slide-out room 22 to permit configuration of the timing shaft 2908 across an upper side of the slide-out room 22. However, the timing shaft 2908 may be provided along a lower side of the slide-out room 22 in other examples.

FIG. 29C illustrates a close up view of a central portion of the drive chain 2904, according to one or more examples. Here, the drive chain 2904 is configured as a continuous chain, or closed loop of chain, and is thus connected at its free ends 2906a, 2906b. Here, for example, the drive chain 2904 is adjustably connected at free ends 2906a, 2906b via an adjustable chain connector 2907. Also, a pair of first drive cables 2910a, 2910b and a pair of second drive cables 2912a, 2912b are secured relative to the drive cable 2904. The drive cables 2910a, 2910b, 2912a, 2912b may be adjust-

ably connected to the drive chain 2904, or otherwise connected to the drive chain 2904. Here, the drive cables 2910a, 2910b, 2912a, 2912b each include an integral bead or stop member 2909 received within a cable chain connector 2911 configured to permit both rotation of the drive cables 2910a, 2910b, 2912a, 2912b within the cable chain connector 2911 as well as axial translation of the drive cables 2910a, 2910b, 2912a, 2912b through the cable chain connector 2911 until the bead 2909 contacts the cable chain connector 2911. In other examples, the drive cables 2910a, 2910b, 2912a, 2912b may be adjustably connected to the drive chain 2904.

Returning to FIGS. 29A-29B, the drive cables 2910a, 2910b, 2912a, 2912b are each connected to a bracket positioned on the slide-out room 22 at an outer lower corner A, inner lower corner B, outer upper corner C, and inner upper corner D, respectively, of the slide-out room 22. Rotation of the drive chain 2904 in either direction pulls or tensions one of the drive cables 2910a, 2910b, 2912a, 2912b, which pulls the slide-out room 22, and this movement of the slide-out room 22 activates the remaining drive cables 2910a, 2910b, 2912a, 2912b. For example, rotation or cycling of the drive chain 2904 in a direction indicated by R1 tensions the first drive cable 2910a, such that the drive cable 2904 pulls the first drive cable 2910a causing the outer lower corner A of the slide-out room 22 to move in the first direction D1. This movement of the slide-out room 22 causes the inner lower corner B of the slide-out room 22 to move in the first direction D1 with the outer lower corner A being pulled by the first drive cable 2910a. The first drive cable 2912a is attached at the inner lower corner B of the slide-out room 22 and, at its other end, is fixed relative to the second drive cable 2912b (e.g., through the drive chain 2904) such that tensioning of the drive cable 2912a activates or tensions the second drive cable 2912b that is connected to the outer upper corner C. Thus, the slide-out room 22 activates or tensions the drive cables 2912a, 2912b to pull the outer upper corner C of the slide-out room 22 as the drive chain 2904 activates or tensions the first drive cable 2910a to pull the outer lower corner A. Similarly, reverse operation of the drive chain 2904 would cause tensioning of the first drive cable 2912a to pull the inner lower corner B of the slide-out room in an opposite direction, which movement of the slide-out room 22 thereby tensions the drive cables 2910a, 2910b interconnecting the outer lower corner A and the inner upper corner D to pull the slide-out room 22 at the inner upper corner D.

The slide-out room 22 may be balanced in a specific orientation during its extension or retraction. For example, the slide-out room 22 may be balanced in an orientation where the forward or outside wall 38 of the slide-out room 22 is parallel to the side 16 of the vehicle 10 and/or where the floor of the slide-out room 22 is parallel to the floor of the vehicle 10. In some examples, the slide-out room 22 is balanced on one or more rollers or bars that are secured to the vehicle 10. For example, the bottom jamb 20 of the opening 18, which is positioned proximate to the floor of the slide-out room 22, may include one or more rollers or bars on which the slide-out room 22 may be balanced in a constant orientation as it slides between its fully extended and retracted positions. In some examples, the roller(s) or bars or other balancing means may be positioned on the jambs 20 positioned next to the sidewalls 34, 36 of the slide-out room 22. Regardless of whether any such rollers or bars are utilized and the location at which they are positioned about the opening 18 relative to the slide-out room 22, the drive mechanisms disclosed herein (e.g., the drive assembly 2800, 2900) may balance the slide-out room 22 in a specific orientation, and maintain the slide-out room 22 in



that specific orientation, as the drive cables are actuated to move the slide-out room 22. Thus, the slide-out room 22 may maintain constant orientation as the drive cables pull it in either a first or second direction. In one examples, one or more of the drive cables pull the slide-out room 22 in a first direction towards and into its fully extended position in a manner that the floor of the slide-out room 22 maintains its orientation (e.g., parallel to the floor of the vehicle) during the entire time that it is moved in the first direction. Similarly, one or more of the drive cables will maintain that orientation of the slide-out room 22 and balance the slide-out room 22 as they pull the slide-out room 22 in the second direction towards and into its fully retracted position. Thus, the drive cables may balance the slide-out room 22 in a particular orientation as they actuate the slide-out room 22 in either the first direction or the second direction. Also, in this example one or more rollers, balancing members, or wear strips (or wear bars) may be positioned about the opening 18 in the vehicle 10 for at least partially supporting the slide-out room 22 as the drive out cables balance and actuate the slide-out room 22 in the first direction and/or second direction. The wear strip comprise a strip of plastic with a slick surface and which may operate as a seal too.

FIGS. 30A-30G illustrate various cable-chain adjusters configured to adjust tension of the drive cables and/or the drive chain, according various embodiments. The cable-chain adjusters illustrated in FIGS. 30A-30G, which are sometimes referred to as connectors, adjustably connect one or more drive chains 3000 to one or more drive cables 3002, and may be utilized with various slide-out drive assemblies, such as those described herein. The connectors described with reference to FIGS. 30A-30G may be utilized within jamb frames or elsewhere about the vehicle, such as beneath the slide-out room 22.

FIG. 30A illustrates a connector 3004 that interconnects a pair of drive chains 3000a,3000b and actuates a pair of drive cables 3002a,3002b, according to one or more embodiments. The connector 3004 may be utilized in a variety of slide-out drive assemblies, and, in some examples, a pair of the connectors 3004 may be utilized within a jamb mounted slide out drive assembly. A first drive cable 3002a extends from one end of the connector 3004 and a second drive cable 3002b extends from a second opposite end of the connector 3004. Here, the pair of drive chains 3000a,3000b are strands of chains having chain ends, and each chain ends of each drive chain 3000a,3000b is connected to a separate connector 3004. Thus, drive chains 3000a,3000b and the pair of the connectors 3004 form an endless loop that may rotate within a jamb assembly and that may be driven to actuate the drive cables 3002 extending from the jamb assembly. Each of the connectors 3004 may be formed from a pair of U-shaped members that are fastened together. Each drive cable 3002 includes a stud 3006 that extends through an aperture 3008 formed in each stamped U-shaped member and secured from an interior portion of the connector 3004 via a nut 3010. The stud 3006 may include a threaded portion that is inserted within and corresponds with a threaded bore portion of the nut 3010, and axially translates therein upon rotation of the nut 3010. In addition, the drive cables 3002a,3002b may be adjustable with respect to the connector 3004, for example, via a stud 3012 having a threaded portion that axially translates within a threaded bore of a nut 3014 upon rotation of the nut 3014. Either or both of the nuts 3008,3014 may be configured to inhibit it from "backing off" its respective stud 3006,3012 after being tightened. For example, the nuts 3008,3014 may include spring lock washers that help lock the nuts 3008,3014 in place and inhibit loosening due to

vibration. The U-shaped members that together define the connector 3004 may be stamped and may be secured together via a variety of means, including welding and/or fasteners. In the illustrated example, the U-shaped members are held together via the studs 3006,3012. In some examples, a locking device such as a lock washer is provided in-between the U-shaped members and aligned with the apertures through which the studs 3006,3012 are inserted.

FIG. 30B illustrates an alternate connector 3020 that is spliced within the drive chain 3000 and actuates four (4) drive cables 3002a,3002b,3002c,3002d, according to one or more embodiments. The connector 3020 is similar to the connector 3004 of FIG. 30A, except that it is utilized with a single drive chain 3000, interconnecting opposing ends thereof to form an endless loop within a jamb assembly, and is adjustably attached to four (4) drive cables 3002a,3002b, 3002c,3002d, such that rotation of the drive cable 3000 activates all four (4) drive cables 3002a,3002b,3002c, 3002d. The connector 3020 may be utilized in a variety of slide-out drive assemblies, and, in the illustrated example, is utilized within a jamb mounted slide out drive assembly.

FIG. 30C illustrates an alternate connector 3030 interconnecting the pair of drive chains 3000a,3000b and actuates a pair of drive cables 3002a,3002b, according to one or more embodiments. As described with reference to FIG. 30, the pair of drive chains 3000a,3000b are strands of chains and a pair of the connectors 3030 are utilized to splice the drive chains 3000a,3000b together, thereby forming an endless loop within a jamb assembly that may be driven to actuate the drive cables 3002. Thus, the connector 3030 is similar to the connector 3004 of FIG. 30A, except that the connector 3030 provides greater adjustment of the drive cables 3002 in a relatively smaller envelope due to extension portions to which the drive cables 3002a,3002b are connected. Here, each of the U-shaped members that are held together to form the connector 3030 include a pair of oppositely extending chain connector portions such that, when the U-shaped members are assembled together as illustrated and described herein, the oppositely extending chain connector portions overlap and define the extension portions to which the ends of the drive chains 3000a,3000b are attached. In the illustrated example, the U-shaped members are held together via the studs of the drive cables and/or drive chains 3000a, 3000b. Also in the illustrated example, the nuts that are utilized to adjust tension in the drive cables 3002 are provided exterior an internal space of the connector 3030, proximate to the extension portion. Thus, the amount of travel of the stud is not limited by the amount of travel permitted within the internal space of the connector 3030, but, rather, the stud may translate through the 3030 and be adjusted to numerous lengths without obstruction from the body of the connector 3030. The connector 3030 may be utilized in a variety of slide-out drive assemblies, and, in the illustrated example, is utilized within a jamb mounted slide out drive assembly.

FIG. 30D illustrates an alternate connector 3040 that is spliced within the drive chain 3000 and actuates four (4) drive cables 3002a,3002b,3002c,3002d, according to one or more embodiments. The connector 3040 is similar to the connector 3030 of FIG. 30C, except that just one connector 3040 is utilized with a single drive chain 3000, interconnecting opposing ends of the drive chain 3000 to form an endless loop within the jamb assembly, and is adjustably attached to four (4) drive cables 3002a,3002b,3002c,3002d, such that rotation of the drive cable 3000 activates all four (4) drive cables 3002a,3002b,3002c,3002d. The connector 3040 may be utilized in a variety of slide-out drive assem-



blies, and, in the illustrated example, is utilized within a jamb mounted slide out drive assembly.

FIGS. 30E and 30F illustrate a connector 3050 configured to attach to an end of the drive chain 3000, according to various embodiments. Unlike the connectors described with reference to FIGS. 30A-30F, the connector 3050 does not splice together two separate strands of the chain 3000. Rather, the drive chain 3000 is configured as a strand in these examples, and the connector 3050 is attached at a first end of the strand (of drive chain 3000) and a second connector (not illustrated) is attached at a second end of the strand (of drive chain 3000). In addition, a second drive chain (not illustrated) with a second pair of connectors 3050 may be provided to actuate drive cables (not illustrated) attached to a second side of the slide-out room 22. Here, each of the drive cables 3002a,3002b includes a stud having a threaded portion, and the threaded portions of the studs extend through apertures in the connector 3050. The threaded portions of the studs extend into and through lock nuts, which may be rotated to cause linear translation of the stud through the apertures and relative to the connector 3050. Thus, the tension in the drive cables 3002 may be adjusted by rotating the lock nuts.

FIG. 30F illustrates an example of the connector 3050 having an anti-vibration device 3060 that inhibits the lock nut from rattling loose or backing off. Here, the anti-vibration device 3060 is foam block provided over the lock nut. The anti-vibration device may be made of various other materials, however, such as various elastomeric materials, etc. In other examples, the anti-vibration device is differently arranged relative the lock nut, for example, in between the lock nut and the connector 3050.

FIG. 30G illustrates another example connector 3070 for adjusting the drive cable 3002 relative to the drive chain 3000, according to one or more examples. In this example, the drive chain 3000 is continuous and thus provided as a loop. The drive chain 3000 may be provided within jamb assemblies arranged about opposite sides of the opening 18, and driven therein via one or more drive sprockets also arranged within the jamb assemblies. The connector 3070 includes a pair of opposing plates 3072,3074 that may be pinned together through one or more links of the drive chain 3000. A cable mount 3076 having an aperture 3078 extending there-through is secured to one of the opposing plates 3072,3074 (e.g., the plate 3074). Each of the drive cables 3002 includes a stud 3080 and at least a portion of the stud 3080 is threaded. The stud 3080 extends through the aperture 3078 of the cable mount 3076, from a first side of the aperture 3078 to a second side of the aperture 3078, and through a correspondingly threaded bore of a nut 3082 that is arranged proximate to the second side of the aperture 3078. The nut 3082 may be rotated to cause translation of the stud 3080 relative to the cable mount 3076 and through the threaded bore of the nut 3082.

In some examples, the stud 3080 includes at least one flat 3090 and a bore of the aperture 3078 (of the cable mount 3076) through which the stud 3080 extends includes at least one corresponding flat 3092. In the illustrated example, the stud 3080 includes a pair of oppositely disposed flats 3090 that correspond with a pair of oppositely disposed flats 3092 within the aperture 3078. The corresponding flats 3090,3092 are flat surfaces that abut each other as the stud 3080 translates axially within the bore of the cable mount 3076 and inhibit relative rotation between the studs 3080 and the cable mount 3076 due to interference between the corresponding flats 3090,3092. Thus, the flats 3090 on the studs 3080 may be provided without threads, which are otherwise

provided on the stud 3080, such that rotation of the nut 3082 engages the threaded portions of the stud 3080 while permitting the nut 3082 to rotate over the flats 3090 of the stud 3080 without interference.

FIGS. 31A-31D illustrate a bracket 3100 (sometimes referred to as a stand-off bracket) configured for adjustably connecting a drive cable 3102 to the slide-out room 22, according to one or more embodiments. As hereinafter described, the bracket 3100 permits adjustment of a cable drive slide-out assembly, for example, drive assemblies 2800 and/or 2900, outside of the jamb assemblies 1410a, 1410b.

As illustrated, the bracket 3100 includes a base 3104 configured to be secured to the slide-out room 22, for example, on the left sidewall 34 and/or the right sidewall 36. Accordingly, a plurality of mounting holes 3406 may be provided in the base 3104. In the illustrated example, the mounting holes 3406 are symmetrically provided in the base 3104 relative to a central axis L; however, they may be provided in various other configurations, symmetrical or otherwise, in other examples.

The bracket 3100 also includes a stand-off portion 3110 configured to protrude outward from the slide-out room 22 and receive the drive cable 3102 at a location relative to the sidewall of the slide-out room 22 that provides ample room or space for a user to adjust the tension of the drive cable 3102. The stand-off portion 3110 may include a plurality of holes or recesses. Here, the stand-off portion 3110 includes a pair of insert recesses 3112 symmetrically disposed relative to the central axis L; however, they may be provided in various other configurations, symmetrical or otherwise, in other examples. Also, the stand-off portion 3110 includes a pair of cable end recesses 3114 for receiving the drive cable 3102 or a threaded stud 3116 thereof. Here, the cable end recesses 3114 are provided on the top and bottom of the stand-off portion 3110, symmetrical relative to the central axis L; however, they may be provided on either the top or bottom of the stand-off portion 3110 in other examples. In the illustrated example, the threaded stud 3116 is shown extending through the cable end recess 3114 provided in the bottom of the stand-off portion 3110, such that a nut 3118 may receive the threaded stud 3116 exterior the stand-off portion 3110 and be rotated to adjust tension in the drive cable 3102. Here, the nut 3118 abuts a leg or flange 3119 of the stand-off portion 3110 when engaging the threaded stud 3116 extending through the cable end recess 3114 defined in the flange 3119.

The bracket 3100 also includes an insert 3120 arranged within the stand-off portion 3110. The insert 3120 is configured to receive the drive cable 3102 and redirect it towards the cable end recesses 3114 without damaging or weakening the drive cable 3102. For example, without the insert 3120, the drive cable 3102 would abut the stand-off portion 3110 and be re-routed or directed at a sharp angle, which may damage or otherwise weaken the drive cable 3102. Here, the insert 3120 is made of a plastic material and includes a radiused channel 3121 configured to receive the drive cable 3102 and redirect it towards the cable end recesses 3114 without stressing or damaging the drive cable 3102. For example, the radiused channel 3121 is configured to ensure that the drive cable 3102 is not subject to a ninety degree bend, which may cause damage over time to the drive cable 3102. In one example, the radiused channel 3121 includes a three-quarter inch radius cable channel; however, various other dimensions may be provided, for example, depending on the material of the drive cable 3102, without departing from the present disclosure.



The insert **3120** includes a face portion **3122** arranged within the insert recesses **3112**. Also, a channel or recess **3124** is provided in the face portion **3122** for receiving the drive cable **3102**. The recess **3124** extends through the face portion **3122** and into the radiused channel **3121**, such that the drive cable **3102** may extend there-through and be redirected towards the cable end recess **3114** via the radiused channel **3121**. In some examples, the insert **3120** is configured to self-align with the drive cables **3102** extending into the recess **3124**. Here, the face portion **3122** is slightly smaller than the insert recesses **3112** such that it, and the insert **3120**, may move side to side within the insert recesses **3112** relative to the stand-off portion **3110** (i.e., towards or away from the slide-out room **22**) and thus align with the orientation of the drive cable **3102** extending from the jamb assembly **1410**.

In some examples, the insert **3120** is secured within the insert recess **3112**. In some of these examples, the insert **3120** may clip into the insert recess **3112** such that all relative movement between the insert **3120** and the stand-off portion **3110** is inhibited. However, in other of these examples, the insert **3120** may be secured within the insert recess **3112** in a manner permitting side-to-side movement (or sliding) of the insert **3120** within the insert recess **3112** and thereby permit self-alignment of the insert **3120** relative to the drive cable **3102** extending from the jamb assembly **1410**.

FIGS. **32A-32B** illustrate alternate examples of the bracket **3100** of FIGS. **31A-31D**, according to one or more alternate embodiments. Here, stand-off portion **3110** includes a single insert recess **3112** and a single cable end recess **3114**, provided at opposite ends of the stand-off portion **3110**. Here, for example, a single insert recess **3112** is provided proximate to the bottom side of the stand-off portion **3110** and the cable end recesses **3114** is provided at the top side of the stand-off portion **3110**; however, they may be provided differently. For example, a single insert recess **3112** may be provided at the top side of the stand-off portion **3110** and the cable end recesses **3114** may be provided at the bottom side of the stand-off portion **3110**. Also in the illustrated example, the insert recess **3112** may define a pair of angled surfaces **3202**, and the face portion **3122** of the insert **3120** may include a pair of correspondingly angled surfaces **3204** that abut the angled surfaces **3202** when the insert **3120** is assembled within the stand-off portion **3110**. Also in the illustrated example, the insert **3120** includes a single radiused channel **3121**, but it may instead include a pair of radiused channels **3121** as illustrated in FIGS. **31A-31D**.

FIGS. **33A-33B** illustrate alternate brackets **3300** (i.e., a stand-off bracket) configured for adjustably connecting a drive cable **3302** to the slide-out room **22**, according to one or more alternate embodiments. As hereinafter described, the bracket **3300** permits adjustment of a cable drive slide-out assembly, for example, drive assemblies **2800** and/or **2900**, outside of the jamb assemblies **1410a,1410b**.

The bracket **3300** includes a base **3304** and a stand-off portion **3306**. The base **3304** is configured to mount on the slide-out unit **22** and the stand-off portion **3306** is configured to receive an end **3308** of the drive cable **3302**. Here, the stand-off portion **3308** includes an aperture or recess **3309** through which the end **3308** of the drive cable **3302** extends. In the illustrated example, the recess **3309** is sized and shaped to permit movement of the end **3308** of the drive cable **3302** and alignment of the end **3308** of the drive cable **3302** with the drive cable **3302** extending from the jamb assembly **1410**. In other examples, however, the recess **3309**

is sized and shaped approximately the same as the end **3308** of the drive cable **3308**, thereby inhibiting relative movement of the end **3308** of the drive cable **3302** within the recess **3309**.

As illustrated, a cable adjustment assembly **3320** is provided on the end **3308** of the drive cable **3302**. As hereinafter described, the cable adjustment assembly **3320** is configured to permit tensioning of the drive cable **3302** without having to substantially disassemble the drive assembly and/or access the drive cable **3302** from within the jamb assembly **1410**. In some examples, the cable adjustment assembly **3320** includes a disk **3322** having a shank **3324** integrally extending therefrom. The shank **3324** may include a threaded bore (obscured from view) extending there-through. Here, the recess **3309** is sized and shaped to inhibit the disk **3322** from being pulled there-through.

The cable adjustment assembly **3320** may also include a stop or bead **3326** fixed on the end **3308** of the drive cable **3302** and an externally threaded collar **3328** rotatably arranged over the bead **3326**. Also, the cable adjustment assembly includes a nut **3330** fixed to the externally threaded collar **3328** and configured to permit a user to rotate the externally threaded collar **3328**. The externally threaded collar **3328** is coupled to the end **3308** of the drive cable **3302** to permit relative rotation there-between. Here, the externally threaded collar **3328** is configured to rotate about the bead **3326**, whereas relative axial movement there-between is inhibited in at least one direction. The threads of the externally threaded collar **3328** correspond with the threads with the bore of the shank **3324** such that relative rotation between the shank **3324** and the externally threaded collar **3328** causes relative axial movement between the shank **3324** and the externally threaded collar **3328**.

As mentioned, the externally threaded collar **3328** includes a bore that receives the bead **3326** and inhibits at least some relative axial movement therebetween. Here, the externally threaded collar **3328** is configured to inhibit the drive cable **3302** pulling the bead **3326** out of the externally threaded collar **3328** in a direction away from the disk **3322**; and, in some examples, the externally threaded collar **3328** is also configured to inhibit the drive cable **3302** pushing the bead **3326** out of the externally threaded collar **3328** in a direction towards the disk **3322**. Thus, the bore of the externally threaded collar **3328** may be stepped (i.e., include a larger diameter portion and a smaller diameter portion) to retain the bead **3326** of the drive cable **3302** within the bore of the externally threaded collar **3328** as the externally threaded collar **3328** is rotated to adjust tension in the drive cable **3302**. For example, the drive cable **3302** may have a smaller diameter than the bead **3326** fixed thereon, and the bore of the externally threaded collar **3328** may have a larger diameter portion positioned away from the cable end **3308** and sized to receive the bead **3326**; and the bore of the externally threaded collar **3328** may also include a smaller diameter portion that is positioned towards the end **3308** of the drive cable **3302** and sized to receive the end **3308** of the drive cable **3302**, but sized too small to permit the bead **3326** from being pulled there-through when the externally threaded collar **3328** is threaded within the threaded bore of the shank **3324**. Upon pulling of the drive cable **3302**, the bead **3306** is pulled into contact with a step (obscured from view) within the bore of the externally threaded collar **3328**, and this interference between the smaller diameter portion of the externally threaded collar **3328** and the bead **3326** inhibits the bead **3326** from being pulled out of the externally threaded collar **3328**.



FIGS. 34A-34C and 35A-35C illustrate various examples of the cable adjustment assembly 3320, according to various examples of the present disclosure. As illustrated in FIGS. 34A-34C, the externally threaded collar 3328 and the nut 3330 integrally provided thereon may be provided as a solid unit with a bore 3400 extending there-through, but without any other recesses or gaps. As mentioned, the bore 3400 extending through the externally threaded collar 3328 may include a step (obscured from view) that interferes with the bead 3326 when the drive cable 3302 is pulled, thereby pulling the externally threaded collar 3328 with the end 3308 of the drive cable 3302. FIGS. 34A-34C illustrate an example where the externally threaded collar 3328 and the nut 3330 integrally provided thereon include a gap 3500. Here, the gap 3500 is oriented along and extends into a bore 3502 of the externally threaded collar 3328, and may permit the externally threaded collar 3328 and the nut 3330 to be press fit onto the drive cable 3302 without any disassembly of the jamb assembly 1410, rather than having to thread them onto the drive cable 3302 which may require disassembly of the jamb assembly 1410 to access the other end of the drive cable 3302. Also, FIGS. 35A-35C illustrate the externally threaded collar 3328 including a step feature 3504 that separates a larger diameter portion 3506 of the bore 3502 and a smaller diameter portion 3508 of the bore 3502, with the larger portion 3506 configured to receive the bead 3326, the smaller portion 3508 configured to receive the end 3308 of the drive cable 3302, and the step feature 3504 inhibiting axial movement of the bead 3326 when the drive cable 3302 is pulled. Accordingly, a user may adjust tension in the drive cable 3302 via rotating the externally threaded collar 3328. In the illustrated examples, the user may utilize a tool to rotate the nut 3330 fixed to the externally threaded collar 3328.

The present subject matter affords a simple and reliable slide-out drive assembly and/or mechanism for a slide-out unit such as a slide-out room 22 or slide-out compartment 26. This slide-out drive assembly and/or mechanism is simpler and more reliable than other slide-out drive systems that are presently known. The drive mechanism of the present subject matter assures that the slide-out unit will advance and retract smoothly and evenly, whether power is applied manually or with a motor. Because of the simplicity of the present drive mechanism, there is less that can go wrong than is the case with presently known slide-out operating systems.

Therefore, the disclosed systems and methods are well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the teachings of the present disclosure may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered, combined, or modified and all such variations are considered within the scope of the present disclosure. The systems and methods illustratively disclosed herein may suitably be practiced in the absence of any element that is not specifically disclosed herein and/or any optional element disclosed herein. While compositions and methods are described in terms of "comprising," "containing," or "including" various components or steps, the compositions and methods can also "consist essentially of" or "consist of" the various components and steps. All numbers and ranges disclosed above

may vary by some amount. Whenever a numerical range with a lower limit and an upper limit is disclosed, any number and any included range falling within the range is specifically disclosed. In particular, every range of values (of the form, "from about a to about b," or, equivalently, "from approximately a to b," or, equivalently, "from approximately a-b") disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee. Moreover, the indefinite articles "a" or "an," as used in the claims, are defined herein to mean one or more than one of the elements that it introduces. If there is any conflict in the usages of a word or term in this specification and one or more patent or other documents that may be incorporated herein by reference, the definitions that are consistent with this specification should be adopted.

Use of directional terms such as above, below, upper, lower, upward, downward, left, right, and the like are used in relation to the illustrative embodiments as they are depicted in the figures, the upward or upper direction being toward the top of the corresponding figure and the downward or lower direction being toward the bottom of the corresponding figure.

As used herein, the phrase "at least one of" preceding a series of items, with the terms "and" or "or" to separate any of the items, modifies the list as a whole, rather than each member of the list (i.e., each item). The phrase "at least one of" allows a meaning that includes at least one of any one of the items, and/or at least one of any combination of the items, and/or at least one of each of the items. By way of example, the phrases "at least one of A, B, and C" or "at least one of A, B, or C" each refer to only A, only B, or only C; any combination of A, B, and C; and/or at least one of each of A, B, and C.

What is claimed is:

1. A slidable room drive assembly for a vehicle having a plurality of exterior walls, at least one of which has an opening, and a slide-out room having a pair of opposing sidewalls disposed in the opening and reciprocable between an extended position and a retracted position, the slidable room drive assembly comprising:

a pair of jamb members arranged about the opening in the vehicle proximate to the opposing sidewalls of the slide-out room, each of the jamb members having a sprocket and a drive chain at least partially provided around the sprocket and actuatable in a first or second rotational direction by the sprocket, each of the drive chains being an open strand of chain with a first and second loose end extending from the sprocket such that the strand of chain has a U-shaped orientation when engaging the sprocket; and

a plurality of drive cables within each jamb member, including:

a first cable connected to the first loose end of the drive chain and extending from the jamb member to the front end of the slide-out room,

a second cable connected to the first loose end of the drive chain and extending from the jamb member to the rear end of the slide-out room,

a third cable connected to the second loose end of the drive chain and extending from the jamb member to the front end of the slide-out room, and

a fourth cable connected to the second loose end of the drive chain and extending from the jamb member to the rear end of the slide-out room;



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wherein within each jamb member, the first cable extends from the first loose end in a direction opposite of the second cable, the first cable and the second cable extending along a first common line;

wherein within each jamb member, the third cable extends from the second loose end in a direction opposite of the fourth cable, the third cable and fourth cable extending along a second common line;

wherein actuation of the drive chain in the first rotational direction tensions the first cable to pull the slide-out room from the front end and thereby move the slide-out room in a first direction, and movement of the slide-out room in the first direction thereby tensions the fourth cable and the third cable to further pull the slide-out room from the front end.

2. The slidable room assembly of claim 1, further comprising a motor arranged in each of the jamb members to actuate the respective drive chain, wherein the motors in the jamb members are mechanically timed.

3. The slidable room assembly of claim 1, further comprising a motor arranged in each of the jamb members to actuate the respective drive chain, wherein the motors in the jamb members are electronically timed with a controller.

4. The slidable room assembly of claim 3, wherein the controller monitors back EMF generated in the motors in each of the jamb members and compares the back EMF in the motors to thereby control either or both of the motors.

5. The slideable room assembly of claim 1, wherein the first and second drive cables are a unitary cable strand and/or the third and the fourth drive cables are a separate unitary strand of cable.

6. The slideable room assembly of claim 1, wherein: the first cable is connected to the slide-out room proximate to a lower corner at the front end of the slide-out room;

the second cable is connected to the slide-out room proximate to an upper corner at the rear end of the slide-out room;

the third cable is connected to the slide-out room proximate to an upper corner at the front end of the slide-out room; and

the fourth cable is connected to the slide-out room proximate to a lower corner at the rear end of the slide-out room.

7. The slideable room assembly of claim 1, wherein movement of the slide-out room via tensioning of one of the four drive cables tensions at least one of the remaining four drive cables.

8. The slideable room assembly of claim 7, wherein the first, third, and fourth drive cables are activated in unison.

9. The slidable room assembly of claim 1, wherein the first drive cable and second drive cable are interconnected via a first segment of the drive chain at the first loose end.

10. The slidable room assembly of claim 1, wherein the first drive cable is coupled to the first loose end with a first cable connector and the second drive cable is coupled to the first loose end with a second cable connector.

11. The slidable room assembly of claim 10, wherein the first cable connector is spaced apart from the second cable connector along a first segment of the drive chain at the first loose end.

12. A drive assembly for reciprocating a slide-out room, the slide-out room having a pair of opposing sidewalls and being insertable within an opening in a vehicle body, the drive assembly comprising:

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a strand of drive chain configured to move in a first or second rotational direction in a first plane, the strand of drive chain having a pair of loose ends that are unconnected to each other; and

at least four drive members, the at least four drive members including:

a first drive member connected to a first of the pair of loose ends of the drive chain and extending therefrom to a first end of the slide-out room,

a second drive member connected to the first loose end of the drive chain and extending therefrom in a direction opposite to the first drive member to a second end of the slide-out room, the second end of the slide-out room being opposite the first end of the slide-out room,

a third drive member connected to a second of the pair of loose ends of the drive chain and extending therefrom to the first end of the slide-out room, and a fourth drive member connected to the second loose end of the drive chain and extending therefrom in a direction opposite to the third drive member to the second end of the slide-out room, and

wherein actuation of the drive chain in the first rotational direction engages one of the four drive members to move the slide-out room in a forward direction, and such forward movement of the slide-out room engages at least one of the remaining four drive members to thereby pull the slide-out room in the forward direction, wherein the drive members operate in a second plane that is parallel to the first plane.

13. The drive assembly of claim 12, wherein the four drive members maintain the slide-out room in a uniform orientation relative to the vehicle as the slide-out room moved towards a retracted position or an extended position.

14. The drive assembly of claim 12, wherein the slide-out is balanced on at least one balancing member coupled to the vehicle proximate the opening.

15. The drive assembly of claim 14, wherein the balancing member is at least one roller and/or at least one wear strip.

16. The drive assembly of claim 12, further comprising a jamb assembly arranged about the opening in the vehicle and housing the drive chain and a motor, wherein the motor is configured to actuate the drive chain.

17. The drive assembly of claim 16, further comprising a system for controlling velocity of the motor, wherein the system includes a controller that adjusts voltage supplied to the motor based on back EMF readings monitored by the controller.

18. The drive assembly of claim 17, wherein the motor comprises a pair of motors, each of the pair of motors being arranged in opposite portions of the jamb assembly, wherein the controller adjusts voltage supplied to a first of the pair of motors based on back EMF readings of a second of the pair of motors.

19. The drive assembly of claim 12, wherein at least one of the at least four drive members is adjustably connected to the slide-out room.

20. The drive assembly of claim 19, wherein at least one of the at least four drive members is adjustably connected to a bracket that is secured to the sidewall of the slide-out room.

21. The drive assembly of claim 12, wherein at least one of the at least four drive members is adjustably connected to the drive chain.

22. The drive assembly of claim 21, wherein at least one of the at least four drive members is adjustably connected to a coupling that is secured to the drive chain.



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23. The drive assembly of claim 22, wherein the coupling adjustably connects the first drive member and the second drive member and/or adjustably connects the third drive member and the fourth drive member.

24. A drive assembly for reciprocating a slide-out room, the slide-out room having a pair of opposing sidewalls and being insertable within an opening in a vehicle body, the drive assembly comprising: at least four drive cables and a driver member, each of the at least four drive cables having chain ends at which they are coupled to the driver member and room ends at which they are coupled to the slide-out room, wherein

the driver member is a U-shaped strand of chain with a pair of ends that are unconnected to each other, the driver member being configured to tension or slacken the at least four drive cables upon actuation of the driver member, and

actuation of the driver member in a first direction tensions at least one of the at least four drive cables to move the slide-out room relative to the opening in the vehicle body, and movement of the slide-out room tensions at least one of the remaining at least four drive members

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wherein a first cable of the at least four drive cables extends from a first end of the drive member in a direction opposite of a second cable of the at least four drive cables, the first cable and second cable extending along a first common line.

25. The drive assembly of claim 24, wherein the driver member is a driver sprocket configured to rotate the U-shaped chain arranged around at least a portion of the driver sprocket, the at least four drive cables being coupled to the U-shaped chain.

26. The drive assembly of claim 25, wherein the U-shaped chain is a strand of chain having an opposing pair of free chain ends.

27. The drive assembly of claim 24, wherein each of the at least four drive cables is a discrete cable strand, each cable strand having opposite free cable ends, a first opposite free cable end of the discrete cable strands being connected to the drive member and a second opposite free cable end being connected to the slide-out room.

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